081-874-0044

PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) ON A FIELD STERILIZER

CONDITIONS

You have received DD Form 314 and DA Form 2404 to perform PMCS on a field sterilizer. Necessary materials and equipment: TM 8-6530-004-24&P, TB 38-750-2, tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The scheduled PMCS is performed and all uncorrected unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DD Form 314.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Ensure the frame is properly grounded to the earth ground.	P	F
2. Remove accumulated mineral deposits from the interior of of the jacket and heating elements.	P	F

a. Disconnect the electrical power from the sterilizer.

b. Remove the heater box.

c. Disconnect the wiring from the heater terminals.

d. Remove the hex nuts on the heater assembly.

e. Remove the heater assembly from the jacket.

f. Replace the heater assembly gasket.

g. Inspect the heater assembly and replace the heaters, if damaged.

h. Clean the heating elements and the interior of the jacket.

i. Reassemble and reconnect the heating assembly.

Performance Measures	Results	
3. Lubricate the chamber door (semi-annually).	P	F
a. Remove the chamber door stop.		
b. Remove the door handle retaining ring.		
c. Unscrew the door handle.		
d. Grease the exposed bearings and screw threads with high temperature grease.		
e. Reassemble the door handle, retaining ring, and the stop on the door post.		
4. Lubricate the door hinges (semi-annually).	P	F
a. Loosen the allen screws in the hinge blocks.		
b. Drive the pins out and grease the pins.		
c. Reassemble the door hinge.		
5. Inspect the door gasket.	P	F
a. Check for nicks and cuts.		
b. Replace the gasket if necessary.		
6. Perform a function check.	P	F
7. Inspect all gauges.	P	F
a. Check for broken or cracked glass.		
b. Ensure that the gauge needles do not stick during normal operation.		
8. Inspect the pressure relief valves.	P	F
NOTE: Check the 250° and 270° pressure relief valves during the operation check.		
9. Inspect the low water cut-off adjustment.	P	F
10. Adjust the low water cut-off adjustment, if necessary.	P	F

Performance Measures **Results**

> **CAUTION**
>
> Use the drain line kit supplied with the sterilizer to ensure all the output steam is condensed away properly.

a. Rotate the calibrating screw clockwise one full turn.

b. Operate the sterilizer through a 270° F cycle, and after it is about 10 minutes into the cycle, turn the calibrating screw counterclockwise until the switch trips.

c. Turn the calibrating screw clockwise about 1/8 of a turn and reset the low water cut-off.

d. Verify the operation of the low water cut-off by providing heat to the jacket while draining it. The low water cut-off should activate prior to the jacket being completely drained.

11. Record deficiencies uncorrected on DA Form 2404 and complete appropriate reports and forms. P F

12. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use. P F

REFERENCES:	***Required***	***Related***
	TM 8-6530-004-24&P TB 38-750-2	AR 40-61

081-874-0045

REPAIR A FIELD STERILIZER TO COMPONENT LEVEL

CONDITIONS

You have received DA Form 2407 for repair of a field sterilizer. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, TM 8-6530-400-24&P, tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in TM 8-6530-004-24&P. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for the operator's description of the equipment's malfunction.	P	F
2. Determine maintenance expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain the current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart at Figure 3-88 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.

NOTE: Under certain conditions, the MEL may be waived. (See TB Med 7.)

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

Performance Measures **Results**

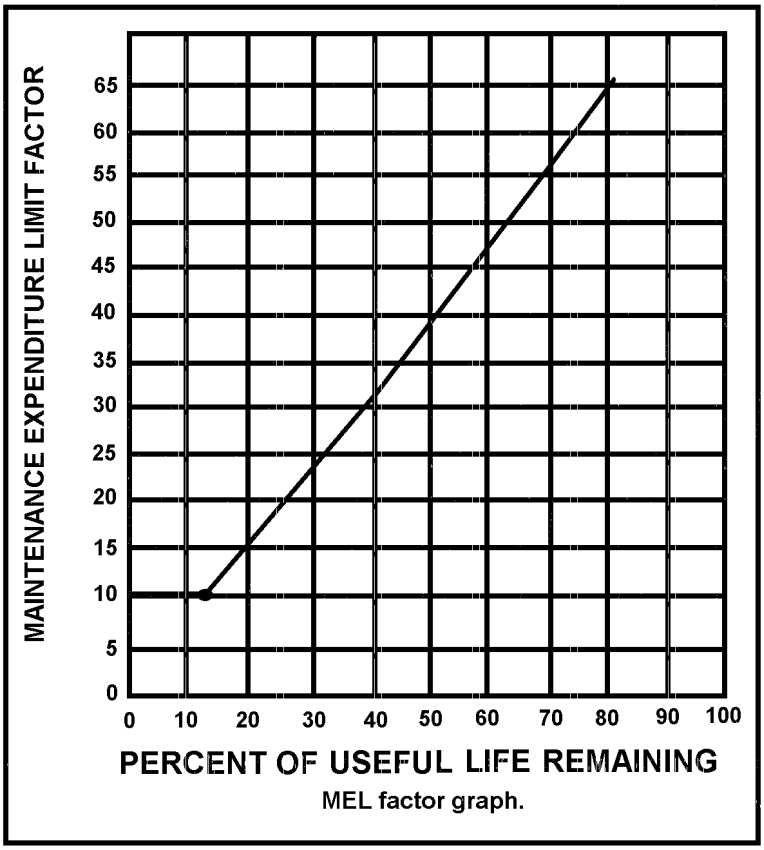


Figure 3-88

3. Perform a visual inspection for obvious damage to-- P F

   a. Hoses.

   b. Gauges.

   c. Cables.

   d. Wires.

4. Perform a function check to confirm symptoms listed on DA Form 2407. P F

NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. See Step 9.

Performance Measures **Results**

5. Troubleshoot and isolate the malfunction to component level. (See Figure 3-89.) P F

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Pilot light does not light. (Electrical operation.)	No power to unit.	Check power line and fuses.
	Defective power switch.	Replace power switch.
	Lamp burned out.	Replace lamp.
	Loose electrical connection.	Check wiring for loose connections or broken wires and repair.
	Low water cut-off tripped.	Press the RESET button.
No steam pressure. (Electrical operation.)	Defective pressure control.	Repair or replace.
	Contactor coil defective.	Replace contactor coil.
Steam pressure high, low, or erratic. (Electrical operation.)	Pressure control sticking or defective.	Repair or replace pressure control.
	Pressure gauge error.	Verify accuracy or replace pressure gauge.
	Loose electrical connection.	Check wiring for broken wire or loose connection and repair.

Figure 3-89

TROUBLESHOOTING (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Excessive time to generate steam. (Electrical operation.)	Low voltage.	Check and adjust.
	Defective heating element.	Replace heating element.
	Loose electrical connections to heaters.	Check wiring to heaters and repair.
	Mineral deposits in jacket.	Clean jacket and heating elements.
Chamber does not come up to operating temperature or pressure.	Operating valve handle incorrectly positioned.	Turn handle to proper position.
	Steam trap stuck open.	Repair steam trap.
	Plugged screen in chamber drain.	Clean screen.
	Door leaks.	Tighten door or replace door gasket.
	Defective thermometer.	Replace thermometer.
	Pressure gauge error.	Verify accuracy or replace gauge.
	Pressure control or pressure regulator set too low.	Adjust regulator.

Figure 3-89 (Continued)

TROUBLESHOOTING (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Low water cut-off trips with water in jacket. (Electrical operation.)	Mineral deposits in jacket.	Clean jacket and heating elements.
	Low water cut-off needs adjustment.	Adjust low water cut-off.
Water in chamber.	Plugged screen in chamber drain.	Remove screen and drain.
	Plugged drain line.	Clean drain line.
	Steam trap does not open for water.	Repair steam trap.
Steam comes out the vacuum dryer.	Vacuum dryer clogged.	Repair vacuum dryer.
	Vacuum dryer not in vertical position.	Straighten vacuum dryer.
Load does not dry.	Vacuum dryer clogged.	Repair vacuum dryer.
	Operating valve handle not properly positioned.	Turn to proper position.
	Heat source shut off during dry cycle.	Continue jacket pressure throughout cycle.
	Vacuum dry time insufficient.	Time for full 15 minutes.
	Materials improperly loaded	Arrange load so moisture will drain off.

Figure 3-89 (Continued)

Performance Measures **Results**

TROUBLESHOOTING (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Solution exhaust too fast or too slow.	Operating valve handle not positioned properly.	Turn to proper position.
	Operating valve plugged or defective.	Clean or repair.
Safety valve releases prematurely or does not release at set pressure.	Defective safety valve.	Replace safety valve.
Case overheats. (Gasoline burner operation.)	Insufficient venting.	Check flue for obstruction and for proper draft.
	Firebox door(s) closed.	Open door(s).
	Wing baffle improperly positioned.	Position wing baffle properly.
No steam pressure. (Direct steam operation.)	Steam valve closed.	Open supply valve.
	Faulty steam control valve.	Repair.
	No steam supply to unit.	Supply steam to unit.
Steam pressure too high, low, or erratic. (Direct steam operation.)	Steam supply less than 35 psi minimum.	Increase steam supply pressure.
	Steam pressure regulator sticking or defective.	Repair or replace steam pressure regulator.

Figure 3-89 (Continued)

Performance Measures **Results**

TROUBLESHOOTING (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Steam pressure too high, low, or erratic. (Direct steam operation.) (Cont'd)	Steam trap clogged or stuck open.	Repair steam trap.
	Pressure gauge error.	Calibrate or replace pressure gauge.
	Drain valve closed.	Open drain valve.

Figure 3-89 (Continued)

6. Determine if the repair cost exceeds the MEL. P F

NOTE: If the repair cost exceeds the MEL, notify the supervisor.

7. Replace the defective component. P F

a. Reassemble the unit.

b. Perform a function check.

8. Determine the disposition of the unit. P F

a. Prepare to release the unit to the user if the functional check is satisfactory.

b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.

c. Refer to the next higher echelon of maintenance, if necessary.

9. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2. P F

a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.

b. Obtain the user's signature for receipt of the unit, as appropriate.

c. Release the unit to the user.

REFERENCES:	*Required*	*Related*
	TM 8-6530-004-24&P	AR 710-2
	TB Med 7	AR 40-61
	TB 38-750-2	

081-874-0046

PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) ON A PROGRAMMABLE SUCTION PUMP

CONDITIONS

You have received DD Form 314 and DA Form 2404 on a programmable suction pump scheduled for PMCS. Necessary material and equipment: manufacturer's service literature, TB 38-750-2, tool kit (medical equipment organizational maintenance), and individual took lit.

STANDARDS

The scheduled PMCS is performed and all uncorrected, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DA Form 314.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Clean the unit and remove dust, lint, and rust.	P	F
2. Visually inspect the unit.	P	F
a. Check the power cable for cracks on the insulation and the electrical plug for bent or broken blades.		
b. Check the rubber hoses for cracks.		
c. Check the case for cracks and other damage.		
d. Check the external 12VDC cable for damage.		
3. Perform 120v/220v operating tests.	P	F
a. 120V/220V continuous suction operation.		
(1) Plug the unit into a wall outlet.		
(2) Push the master power switch in and ensure the Pilot lamp and power mode lamp operate.		

Performance Measures	Results	
(3) Rotate the vacuum control knob fully clockwise and ensure the vacuum control lamp is operational.		
(4) Pinch the rubber tubing and watch gauge ensuring the gauge reads 300 mmHg or more.		
b. Perform 120V/220V Intermittent Suction Operation.		
(1) Plug the unit into a wall outlet.		
(2) Push the master power switch in and ensure the power mode lamp operates.		
(3) Push the suction mode and the suction level switch in and ensure both switches light up.		
(4) Rotate the vacuum control knob fully clockwise and ensure the vacuum control lamp is operational.		
(5) Set both time control knobs to five seconds and ensure the unit cycles on and off every five seconds.		
(6) Pinch the rubber tubing and watch the vacuum gauge and ensure the gauge reads 200 mmHg.		
4. Perform internal 12VDC operating tests.	P	F
a. Check internal 12VDC continuous suction operation.		
(1) Unplug unit.		
(2) Push the master power and power mode switches in and ensure the master power lamp is operational.		
(3) Rotate the vacuum control knob fully clockwise and ensure the vacuum control lamp is operational.		
(4) Pinch the rubber tubing, watch the gauge, and ensure the gauge read 300 mmHg or more.		
b. Check internal 12VDC intermittent suction operation.		
(1) Ensure the unit is unplugged from wall.		

Performance Measures	Results

(2) Push the master power and power mode switches in and ensure the master power lamp is operational.

(3) Push the suction mode and the suction level switches in and ensure both switches are operational.

(4) Rotate the vacuum control knob fully clockwise and ensure the vacuum control lamp is operational.

(5) Set both time control knobs to five seconds and ensure the unit cycles on and off every five seconds.

(6) Pinch the rubber tubing and watch the vacuum gauge ensuring the gauge reads 200 mmHg.

5. Perform external 12VDC operating tests. P F

a. Check 12VDC external continuous suction operation.

(1) Plug the external 12VDC power supply into the jack on the back of the unit.

(2) Push the master power and the power mode switch in and ensure the master power lamp is operational.

(3) Rotate the vacuum control knob fully clockwise and ensure the vacuum control lamp is operational.

(4) Pinch the rubber tubing, watch the gauge, and ensure the gauge reads 300 mmHg or more.

b. Check 12VDC external intermittent suction operation.

(1) Plug external 12VDC power supply into the jack on the back of unit.

(2) Push the master power and the power mode switches in and ensure the master power lamp is operational.

(3) Push the suction mode and the suction level switches in and ensure both switches light up.

(4) Rotate the vacuum control knob fully clockwise and ensure the vacuum control lamp is operational.

Performance Measures	Results
(5) Set both time control knobs to five seconds and ensure the unit cycles on and off every five seconds.	
(6) Pinch the rubber tubing and watch the vacuum gauge ensuring the gauge reads 200 mmHg.	
6. Lubricate the casters with graphited oil.	P F
7. Record deficiencies uncorrected on DA Form 2404 and complete the appropriate reports and forms.	P F
8. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use.	P F

REFERENCES:	*Required*	*Related*
	Manufacturer's Service Literature TB 38-750-2	AR 40-61

081-874-0047

CALIBRATE A PROGRAMMABLE SUCTION PUMP

CONDITIONS

You have received DD Form 314 and DA Form 2404 on a programmable suction pump scheduled for calibration. Necessary materials and equipment: manufacturer's service literature, TB 38-750-2, DC triggered oscilloscope with a minimum 5 second horizontal sweep storage capability, small slotted screwdriver, calibrated vacuum gauge, tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The scheduled calibration is performed and all uncorrected, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the calibration. The calibration is recorded of DD Form 314.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review the manufacturer's service literature.	P	F
2. Calibrate and verify maximum low vacuum level limit.	P	F
a. Set the control for either AC or DC operation and ensure the batteries have been fully charged if using DC operation.		
b. Select CONTINUOUS and LOW VACUUM operation.		
c. Turn the vacuum regulator on and fully clockwise.		
d. Occlude the rear panel vacuum inlet and adjust R2 for a 200 mm Hg reading on the front panel vacuum gauge.		
e. Attach a calibrated vacuum gauge to vacuum inlet to verify the reading.		
3. Calibrate and verify intermittent timing circuits.	P	F
a. Set the controls for either AC or DC operation and ensure the batteries have been fully charged if using DC operation.		
b. Select INTERMITTENT and LOW VACUUM operation.		

Performance Measures	Results

c. Set the timers for 5 seconds ON, 5 seconds OFF.

d. Turn the vacuum regulator on and fully clockwise.

e. Trigger the oscilloscope sweep to begin when the motor turns ON.

NOTE: Use the positive voltage motor input.

f. Adjust R36 to set the ON time circuit for a 5 second, ±0.5 seconds, sweep.

NOTE: Use the store function to verify.

g. Trigger the oscilloscope sweep to begin when the motor turns OFF.

NOTE: Use the positive voltage motor input.

h. Adjust R35 to set the OFF time circuit for a 5 second, ±0.5 seconds, sweep.

4. Record the results of the calibration on the appropriate forms and records. P F

REFERENCES:	***Required***	***Related***
	Manufacturer's Service Literature TB 38-750-2	AR 40-61

081-874-0048

REPAIR A PROGRAMMABLE SUCTION PUMP TO MODULE/BOARD LEVEL

CONDITIONS

You have received DA Form 2407 for repair of a programmable suction pump. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, manufacturer's service literature, tool kit (medical equipment organizational maintenance), individual tool box, and test measurement diagnostic equipment.

STANDARDS

The malfunction is isolated to module/board level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's service literature. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measure	**Results**	
1. Review DA Form 2407 for operator's description of the equipment malfunction.	P	F
2. Determine maintenance expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain the current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart at Figure 3-90 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.

NOTE: Under certain conditions, the MEL may be waived. (See TB Med 7.)

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

Performance Measures **Results**

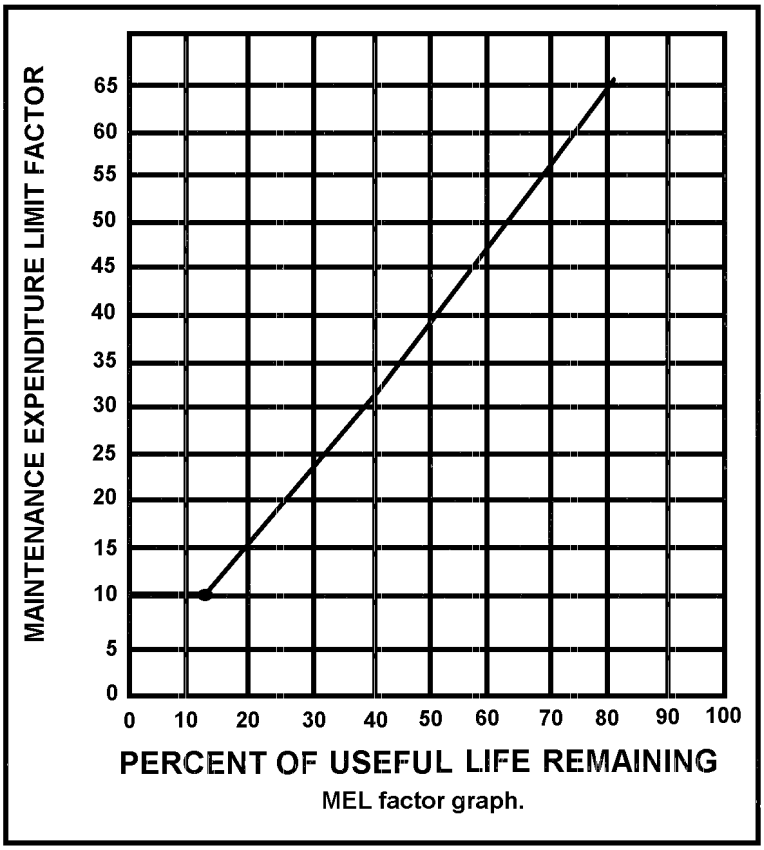


Figure 3-90

3. Visually inspect the equipment for burned, broken, loose, or missing components or wires. P F

4. Perform a function check to confirm symptoms listed on DA Form 2407. P F

NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 10.)

5. Troubleshoot the malfunction to module/board level. (See Figure 3-91.) P F

Performance Measures **Results**

TROUBLESHOOTING

Symptom:	Action:
No Vacuum or weak vacuum.	Check controls: Master power switch on; continuous suction mode; high vacuum selected; regulator fully clockwise. Check hose and hose connections for cracks and crimps. Verify that pump turns easily and that set screws are tight between pump and motor. If L1 and L3 are illuminated, check for voltage at motor input, Q1-Q3, S5A, and R3. Momentarily select low vacuum level and verify voltage at R2. If L1 is on and L3 fails to light, test L3 for open. Check F2 and S3 for voltage. If L1 and L3 are both off, test to determine if L1 is open. Check S1A and S1B connections. Check for voltage outputs from D1-5 T1, S2A, and F1 on AC power line. Check for voltage output from B1, B2, and S2B on internal 12VDC line.
No internal battery power.	Check controls: Master power switch, power mode switch depressed. Check output of B1 and B2 through S2B.
Poor intermittent suction.	Check controls: Master power switch, intermittent suction mode, low vacuum level, regulator fully clockwise, timer set for 5 seconds, OFF timer set for 5 seconds. Verify Q5's base voltage is OVDC during ON cycles and 12VDC during OFF cycles. If not, replace PC board.

Figure 3-91

Performance Measures **Results**

TROUBLESHOOTING (Continued)

Symptom:	Action:
Poor intermittent suction.	Verify Q1 is turning on and off at regular intervals. If not, replace PC board.
	Check the 5VDC regulator for proper output. If erratic operation continues, inspect the PC board closely for shorts, bad solder joints, and/or loose connector cables.
Motor will not turn on but solenoid activates.	Check IC3 and its associated circuits. If any problems are present, replace PC board.
ON or OFF cycle does not terminate.	Replace PC board.

Figure 3-91 (Continued)

6. Determine if the repair cost exceeds the MEL. P F

NOTE: If the repair cost exceeds the MEL, notify the supervisor.

7. Repair or replace the malfunctioning module/board. P F

8. Perform a function check. P F

9. Determine the disposition of the unit. P F

a. Prepare to release the unit to the user if the function check is satisfactory.

b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.

c. Refer to the next higher echelon of maintenance, if necessary.

Performance Measures	Results
10. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P F

a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.

b. Obtain the user's signature for receipt of the unit, as appropriate.

c. Release the unit to the user.

REFERENCES:	*Required*	*Related*
	Manufacturer's Service Literature TB Med 7 TB 38-750-2	AR 40-61

081-872-0043

COMPUTE AUTHORIZED STOCKAGE LEVELS FOR MEDICAL SUPPLIES USING THE DAYS OF SUPPLY (DOS) COMPUTATION

CONDITIONS

You are assigned to an IMSA. The reorder point has been penetrated for stocked medical supplies. Necessary materials: stock accounting record file and DA Form l300-2.

STANDARDS

The reorder point and requisitioning objective are accurately computed. All required entries are made on DA Form 1300-2 without error.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
NOTE: Refer to DA Pam 710-2-2 and applicable appendix for steps 1, 5, and 7.		
1. Complete the heading of the Computation Card, if necessary.	P	F
2. Enter the current month and year on line 1 of the first blank column.	P	F
3. Enter the quantity demanded during the control period(QDCP) on line 2.	P	F
4. Enter the order shipping time in days (OST) on line 3.	P	F
NOTE: Formula abbreviations in the appendix of DA Pam 710-2-2 in some cases are slightly different than the abbreviations in Chapter 4, DA Pam 710-2-2 and DA Form 1300-2. The abbreviations in the appendix have an added "D" for days and "Q" for quantity. The abbreviations mean the same thing.		
5. Compute the requisitioning objective quantity (RO).	P	F
6. Enter the requisitioning objective quantity (RO).	P	F
7. Compute the reorder point quantity (ROP).	P	F
8. Enter the reorder point quantity (ROP).	P	F
9. File the Computation Card with the Stock Accounting Record.	P	F

REFERENCES:	*Required*	*Related*
	AR 40-61 AR 710-2 DA Pam 710-2-2 AMDF	None

101-521-1151

ORDER SUPPLIES AND EQUIPMENT

CONDITIONS

You have been directed to prepare a request for supplies. Necessary materials: AR 710-2, DA Pam 710-2-1, authorization documents, blank request forms, AMDF, DA Pam 25-30, and document register.

STANDARDS

A supply request is prepared without rejection from SSA.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
NOTE: Refer to DA Pam 25-30 and authorization documents for steps 1 and 2. Refer to DA Pam 710-2-1 for steps 3 through 6.		
1. Screen items requested for proper authorization.	P	F
2. Compile identification data on items to be requested.	P	F
3. Select appropriate request forms.	P	F
4. Prepare a request for a single or multiple line item item request.	P	F
5. Enter the request on a document register.	P	F
6. Enter the document number on the request document.	P	F
7. Forward the request form to the SSA.	P	F

REFERENCES:	***Required***	***Related***
	AMDF AR 710-2 DA Pam 25-30 DA Pam 710-2-1	None

081-872-0037

PREPARE DA FORM 3318 FOR THE FIRST DEMAND OF A NONSTOCKED (FRINGE) MEDICAL REPAIR PART

CONDITIONS

You have received a request for the first demand of a nonstocked (fringe) medical repair part. You must prepare DA Form 3318. Necessary materials: AMDF, blank DA Form 3318, and DA Form 2765 or 2765-1.

STANDARDS

All required entries are made on DA Form 33l8 without error.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
l. Enter the national stock number of the item in the block at the top of DA Form 33l8.	P	F
2. Enter the essential elements of data on the title insert at the bottom of DA Form 33l8.	P	F
3. Post entries to the DEMANDS section of DA Form 3318.	P	F
4. Prepare DA Form 2765 or 2765-1 as a request for the item.	P	F
5. Send the request to the supply support activity.	P	F
6. File DA Form 3318 in the nonstocked (fringe) file.	P	F

REFERENCES:	***Required***	***Related***
	AR 40-61 AR 710-2 DA Pam 710-2-1	None

081-872-0054

MAINTAIN DA FORM 3318 FOR NONSTOCKED(FRINGE) MEDICAL REPAIR PARTS

CONDITIONS

You are required to maintain DA Form 3318 for medical repair parts that have had at least one demand. Necessary materials: DA Form 3318 and DA Form 2765 or 2765-1.

STANDARDS

Take all necessary actions to review and maintain DA Form 3318 for nonstocked repair parts. Make all entries on DA Form 3318 without error.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Make all entries on DA Form 3318 in pencil.	P	F
2. Post demands to DA Form 3318.	P	F
3. Line out demands more than 360 days old.	P	F
4. Mark the appropriate column of the cancelled quantity demanded and adjust the due in quantity.	P	F
5. Enter the document number assigned to the request.	P	F
6. Review the nonstocked file every 90 days.	P	F
a. Remove cards from the file that--		
(1) No longer apply to equipment on hand.		
(2) Have had no demands in the most recent 360 days.		
b. Submit cancellation requests for any dues in that do not apply to equipment on hand.		
7. Take necessary action when a nonstocked item has met PLL stockage criteria but is not added to the PLL.	P	F

Performance Measures	Results	
NOTE: Write the statement: "Commander does not desire to stock this item" on the next line of the DEMANDS Section of DA Form 3318.		
8. Remove DA Form 3318 from the nonstocked file, as required.	P	F
9. Add the quantities of the demands and enter on DA Form 3318.	P	F

REFERENCES:	***Required***	***Related***
	AR 40-61 AR 710-2 DA Pam 710-2-1	None

081-872-0038

ADD A MEDICAL REPAIR PART TO THE DEMAND SUPPORTED PRESCRIBED LOAD LIST (PLL)

CONDITIONS

You have received a request for a nonstocked (fringe) medical repair part. The request is the third demand within 360 days. Necessary references and documents: DA Pam 710-2-1, DA Form 3318, and DA Form 2765 or 2765-1.

STANDARDS

All necessary actions are taken to stock the item and add it to the PLL.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
NOTE: Refer to DA Pam 710-2-1 for step 2.		
1. Post entries in the DEMANDS section of DA Form 3318.	P	F
2. Determine the initial stockage level.	P	F
3. Prepare a request (DA Form 2765 or 2765-1) for a sufficient quantity to fill the current request plus the initial stockage level.	P	F
4. Post entries to the REQUEST section of DA Form 3318.	P	F
5. File DA Form 3318 in prescribed load list files.	P	F
6. Prepare a change to the PLL (DA Form 2063-R) and obtain the unit commander's approval.	P	F
7. Send the PLL change and the request for initial stockage to the supply support activity.	P	F

REFERENCES:	***Required***	***Related***
	AR 40-61 AR 710-2 DA Pam 710-2-1	None

081-872-0055

MAINTAIN THE DEMAND SUPPORTED PRESCRIBED LOAD LIST (PLL) FOR MEDICAL REPAIR PARTS

CONDITIONS

You are required to maintain the PLL. Necessary references and documents: Unit Category Code, mandatory parts list (MPL), DA Pam 710-2-1, blank DA Forms 3318, DA Form 2765 or 2765-1, and PLL.

STANDARDS

Take all necessary actions to review DA Forms 3318 and maintain the PLL for stocked repair parts. Make all entries as required on DA Form 3318 and the PLL without error.

TRAINING/EVALUATION

Training Information Outline

NOTE: Refer to DA Pam 710-2-1 for step 4.

1. Determine the MPL stockage quantity for each repair part.

    a. Select the repair parts stockage quantity from each MPL applicable to the unit.

        (1) Determine the on-hand quantity for each end item.

        (2) Select the quantity from the MPL density column for each repair part that is equal to or nearest to the actual on-hand density.

NOTE: If the repair part is common to two or more types of equipment, select the stockage quantity based on the total number of applicable end items on hand.

    b. Check for MACOM supplements to the MPL.

NOTE: The stockage quantities for items listed in MACOM supplements are shown on the supplements.

2. Update the PLL records.

    a. Items on the current PLL but not on the MPL.

        (1) Make no changes on DA Form 3318 for these items.

        (2) Stock the items as long as the retention category is met.

b. Items on the MPL but not on the PLL.

(1) Prepare DA Form 3318 for each item using stockage code "CS."

(2) Prepare a request for the stockage quantity using UND "C."

(3) Post the request to the document register.

c. Items on the MPL and PLL but the MPL stockage quantity is less than the quantity on the current PLL.

(1) Change the stockage code on the TITLE INSERT of DA Form 3318 to "CS."

(2) Enter the Julian date in the DATE block.

(3) Enter the MPL stockage quantity in the QUANTITY block.

NOTE: Do not change the "authorized stockage level." The quantity should be adjusted during regularly scheduled reviews but never adjusted to the point it is below the MPL stockage quantity.

d. Items on the MPL and PLL but the MPL stockage quantity is greater than the quantity on the current PLL.

(1) Change the stockage code on the TITLE INSERT of DA Form 3318 to "CS."

(2) Enter the Julian date in the DATE block.

(3) Enter the MPL stockage quantity in the QUANTITY block.

(4) Change "the authorized stockage level" to the MPL stockage quantity.

(5) Prepare a request for the amount the authorized stockage was increased. Use UND "C."

(6) Enter the request on the document register.

(7) Post the request to the record of demands.

3. Review DA Form 3318.

a. Compare the storage location of each item with the location listed on the TITLE INSERT and correct any discrepancies.

b. Inventory the items and adjust the balance listed on DA Form 3318, as necessary.

c. Visually check the condition of each item.

NOTE: Damaged items must be repaired or replaced.

d. Compute the authorized stock level for items that have been on the PLL for one full review period (90 days). (See step 4.)

e. Check to ensure the quantity on hand, plus the quantity due in less the quantity due out, equals the authorized stockage level.

(1) Request shortages.

(2) Turn in excess.

f. Post the review results on the next available line in the DEMANDS section.

NOTE: Do not make any posting if the review is for a period during which the item was added to the PLL.

(1) DATE column. Enter the Julian date of the review.

(2) USER column. Enter the letters "REV" to indicate review.

(3) QUANTITY DEMANDED column. Enter the total quantity demanded during the review period.

NOTE: Do not include demands which have been cancelled.

(4) Review entry. Draw a dark line just below the review entry.

4. Adjust PLL authorized stockage quantities.

a. Add the quantity demanded for the item during the last two review periods.

NOTE: One review period is sufficient to determine if an increase in stockage is authorized.

b. Use the appropriate ACWT table to determine the authorized stockage level.

c. Increase authorized stockage level.

(1) Prepare a request for the required quantity.

(2) Post the request on the next available line in the REQUESTS section of DA Form 3318.

(3) Update the Authorized Stock Level block on the TITLE INSERT of DA Form 3318.

(4) Prepare a change to the PLL (DA Form 2063-R).

(5) Forward the PLL change and the request for issue to the supply support activity (SSA).

d. Decrease authorized stockage level.

(1) Update the AUTHORIZED STOCKAGE LEVEL block on the TITLE INSERT of DA Form 3318.

(2) Submit requests for cancellation for any excess dues in.

(3) Turn in excess quantity.

NOTE: Keep quantities less than full unit packs.

5. Update DA Form 2063-R.

a. List changes to the PLL and forward to the SSA as the changes occur.

(1) Repair parts added to the PLL.

(2) Repair parts deleted from the PLL.

(3) Increase to the stockage quantity.

(4) Decrease to the stockage quantity.

b. Enter the new stockage quantity in the OPERATIONAL or BASIC column, as appropriate.

c. Enter "added," "changed," or "deleted" in the REMARKS column for each item to show the type of change.

d. Provide the SSA a new load list at the end of the second and alternating review periods.

Evaluation Guide

Performance Measures	**Results**	
1. Determine the MPL stockage quantity for each repair part.	P	F
2. Update the PLL records.	P	F
3. Review DA Form 3318.	P	F
4. Adjust PLL authorized stockage quantities.	P	F
5. Update DA Form 2063-R.	P	F

REFERENCES:	*Required*	*Related*
	AR 40-61 AR 710-2 DA Pam 710-2-1	None

101-521-1152

REQUEST SUPPLY STATUS FOR HIGH-PRIORITY REQUESTS

CONDITIONS

You have been told the maximum number of calendar days have passed since the document date, and the status has not been received. Necessary materials: document register, blank request for issue or turn-in, and supply status cards.

STANDARD

All follow-up requests are prepared and submitted without rejection by the SSA.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Prepare follow-up request documents.	P	F
2. Post follow-up request documents to the document register for supply actions.	P	F
3. Forward the follow-up documents to the appropriate SSA.	P	F

REFERENCES:	***Required***	***Related***
	AR 710-2 DA Pam 710-2-1	None

Section II
Skill Level 3 Tasks

081-874-0009

REPAIR A FIELD DENTAL X-RAY UNIT TO COMPONENT LEVEL

CONDITIONS

You have received DA Form 2407 for repair of a field dental X-ray unit. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, manufacturer's service literature, digital volt meter, oscilloscope, electromechanical pulse counter, regulating transformer 90-150 VAC, tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's literature. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Training Information Outline

1. Review DA Form 2407 for the operator's description of the equipment's malfunction.

2. Determine the maintenance expenditure limits (MEL) for definite life equipment.

   a. Obtain the current replacement cost.

   b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

   c. Use the chart at Figure 3-92 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

   d. Project a horizontal line to the MEL factor.

   e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.

NOTE: Under certain conditions the MEL may be waived. (See TB Med 7.)

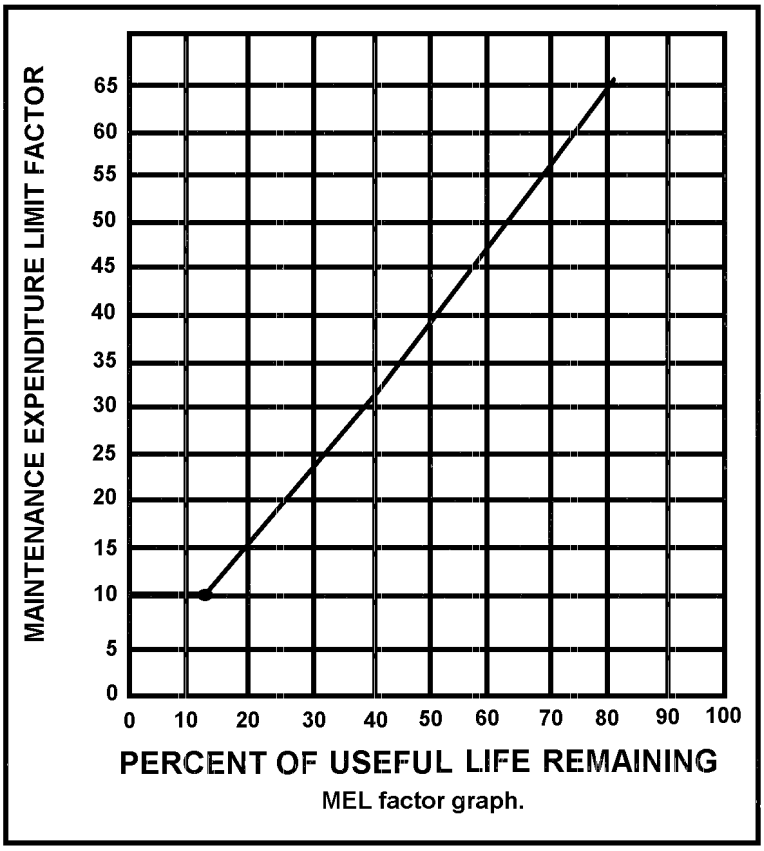


Figure 3-92

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

3. Perform a visual inspection for--

   a. Bare exposed cable wires.

   b. Burned light bulbs.

   c. Cracks in the collimator.

4. Perform a function check to confirm symptoms listed on DA Form 2407.

NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 10.)

5. Troubleshoot and isolate the malfunction to component level. (See Figures 3-93 through 3-99).

6. Determine if the repair cost exceeds the MEL.

NOTE: If the repair costs exceeds the MEL, notify the supervisor.

7. Repair or replace the defective component.

8. Perform a function check.

9. Determine the disposition of the unit.

    a. Prepare to release the unit to the user if the function check is satisfactory.

    b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.

    c. Refer to the next higher echelon of maintenance, if necessary.

10. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.

    a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.

    b. Obtain the user's signature for receipt of the unit, as appropriate.

    c. Release the unit to the user.

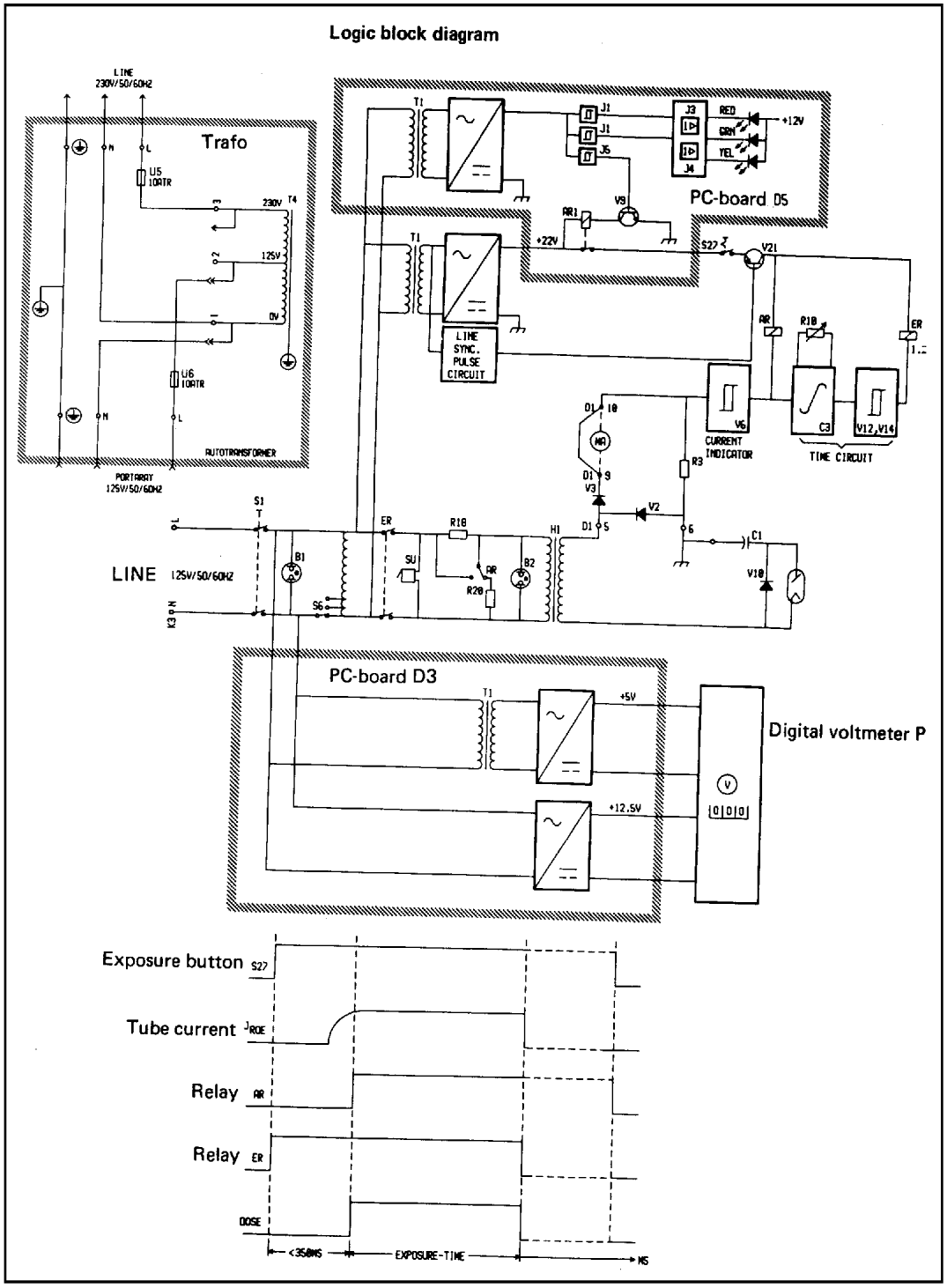

Logic block diagram
LINE 230V/50/60HZ
Trafo
U5 10ATR
230V
125V
0V
U6 10ATR
AUTOTRANSFORMER
PORTARAY 125V/50/60HZ
PC-board D5
LINE SYNC. PULSE CIRCUIT
+22V
+12V
RED
GRN
YEL
CURRENT INDICATOR
TIME CIRCUIT
LINE 125V/50/60HZ
PC-board D3
+5V
+12.5V
Digital voltmeter P
Exposure button S27
Tube current
Relay AR
Relay ER
DOSE
<350MS
EXPOSURE-TIME
MS

Figure 3-93

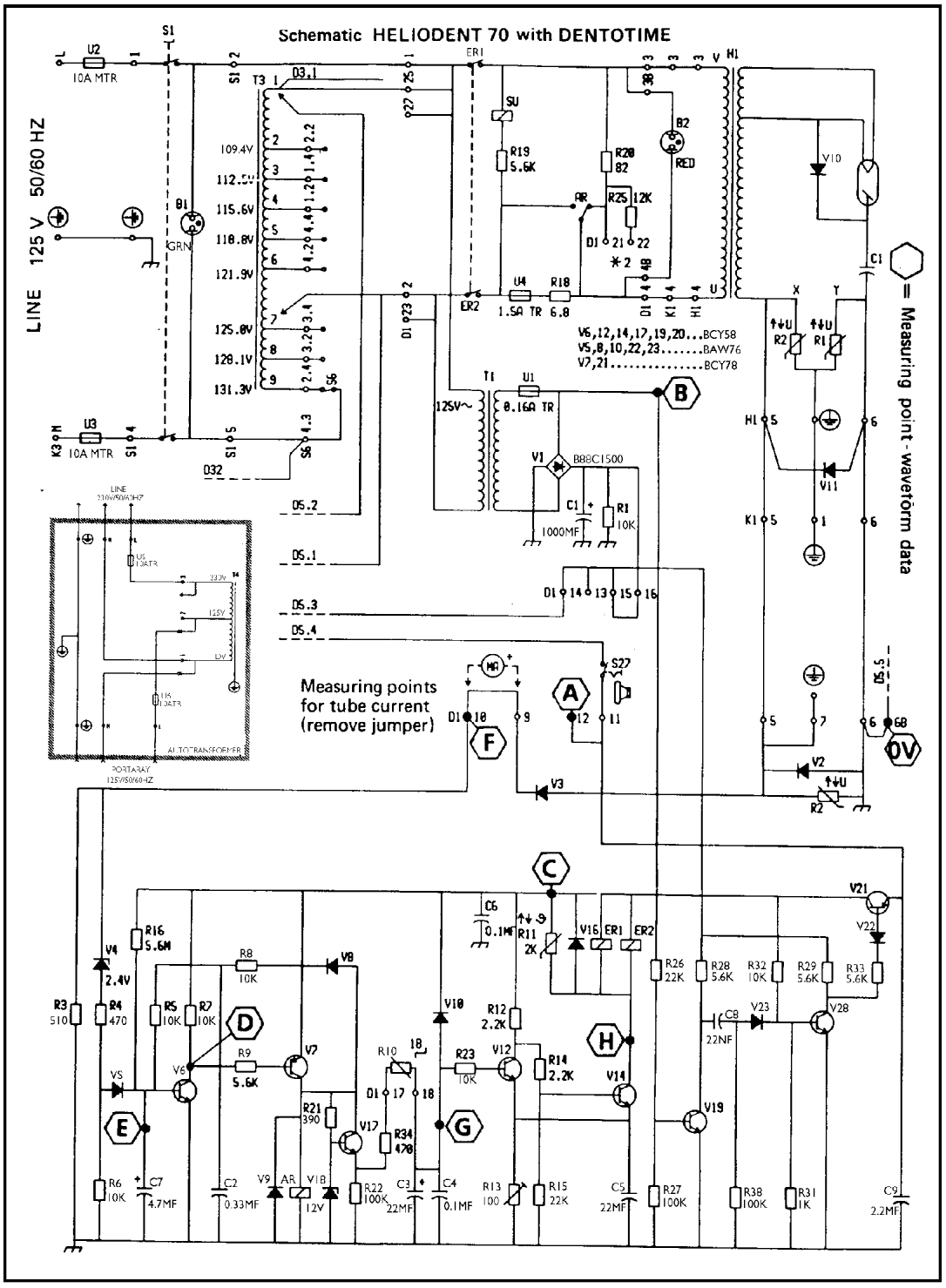

Schematic HELIODENT 70 with DENTOTIME
LINE 125 V 50/60 HZ
10A MTR
Measuring points for tube current (remove jumper)
= Measuring point - waveform data
V6,12,14,17,19,20...BCY58
V5,8,10,22,23.....BAW76
V7,21.....BCY78
BB8C1500
1000MF
0.16A TR
1.5A TR 6.8
ALTOTRANSFORMER
PORTARAY
0V

Figure 3-94

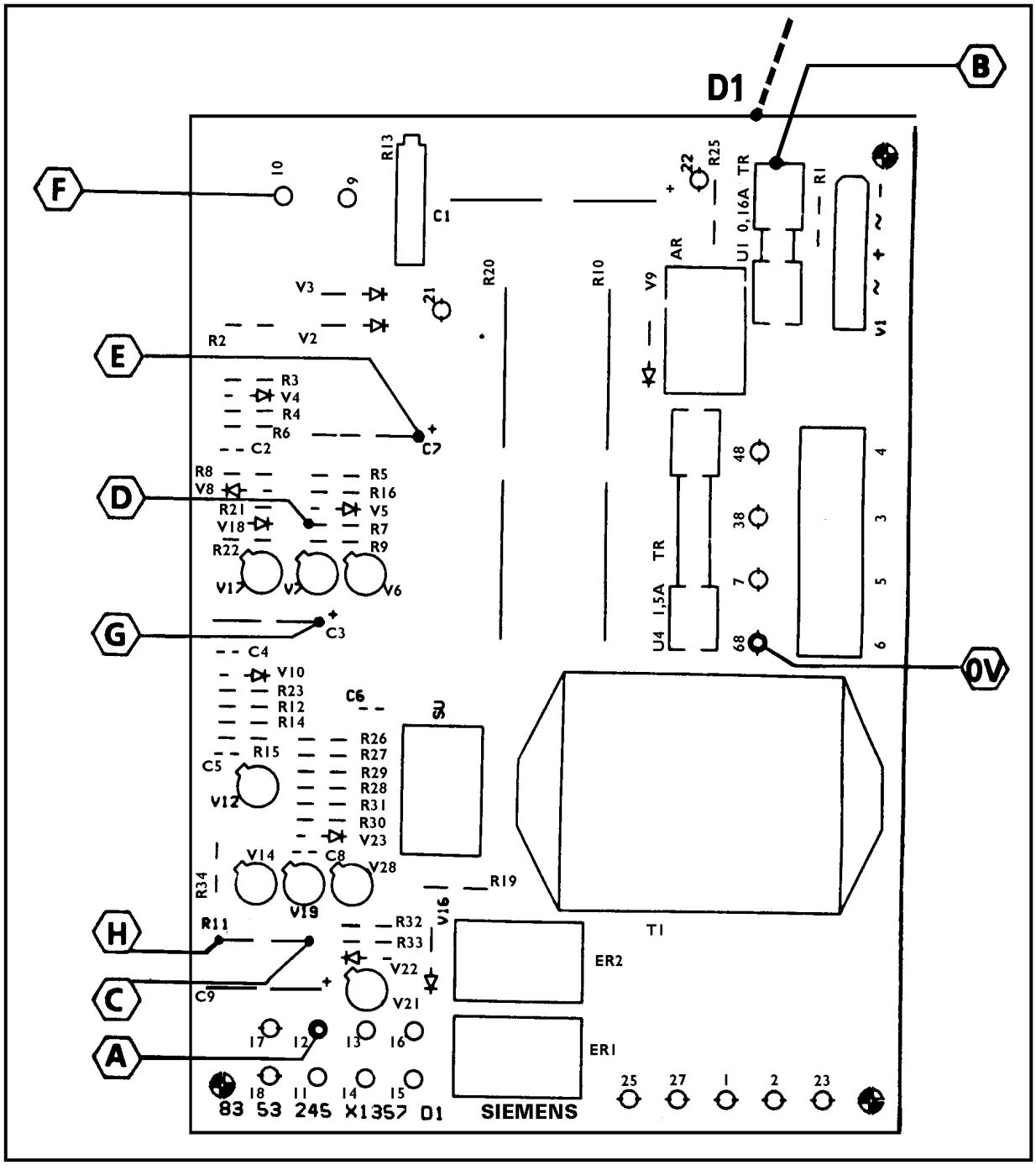

D1
B
F
E
D
G
H
C
A
0V
C1
R13
R25
U1 0,16A TR
R1
V1
AR
V9
R10
R20
V3
V2
R2
R3
V4
R4
R6
C2
C7
R8
V8
R21
V18
R22
R5
R16
V5
R7
R9
V17
V7
V6
C3
C4
V10
R23
R12
R14
C6
R15
C5
V12
R26
R27
R29
R28
R31
R30
V23
V14
C8
V28
R34
V19
R19
V16
R11
R32
R33
V22
V21
C9
T1
ER2
ER1
U4 1,5A TR
48
38
7
68
4
3
5
6
17
12
13
16
18
11
14
15
25
27
1
2
23
83 53 245 X1357 D1
SIEMENS

Figure 3-95

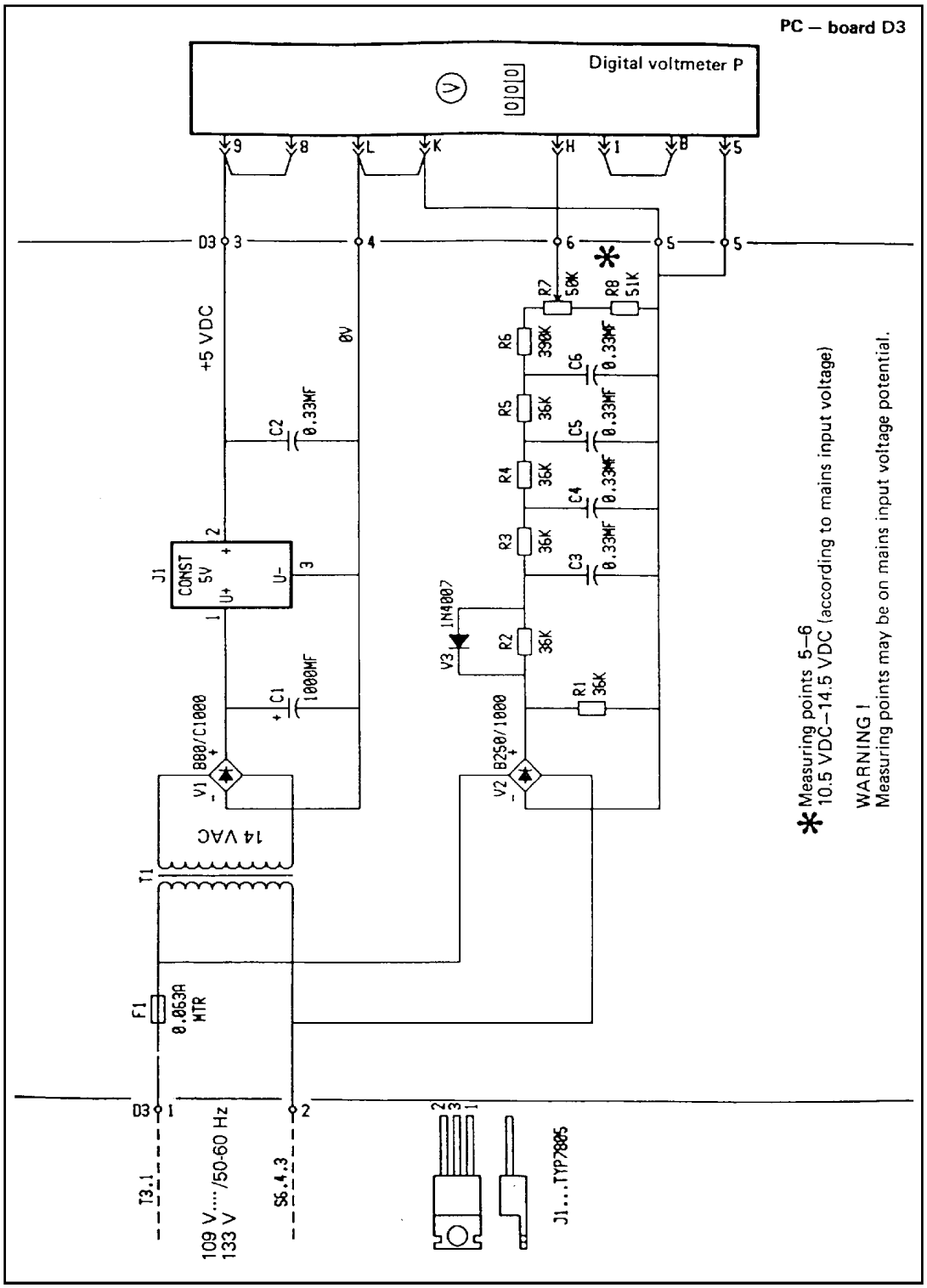

PC – board D3
Digital voltmeter P
9
8
L
K
H
I
B
5
D3
3
4
6
5
5
+5 VDC
0V
R7
50K
R8
51K
R6
390K
R5
36K
R4
36K
R3
36K
R2
36K
R1
36K
C6
0.33MF
C5
0.33MF
C4
0.33MF
C3
0.33MF
C2
0.33MF
C1
1000MF
J1
CONST
5V
U+
U-
2
1
3
V3
1N4007
V1
B80/C1000
V2
B250/1000
14 VAC
T1
F1
0.063A
MTR
D3
1
2
T3.1
109 V..... /50-60 Hz
133 V
S6.4.3
2
3
1
J1...TYP7805
*Measuring points 5–6
10.5 VDC–14.5 VDC (according to mains input voltage)
WARNING !
Measuring points may be on mains input voltage potential.

Figure 3-96

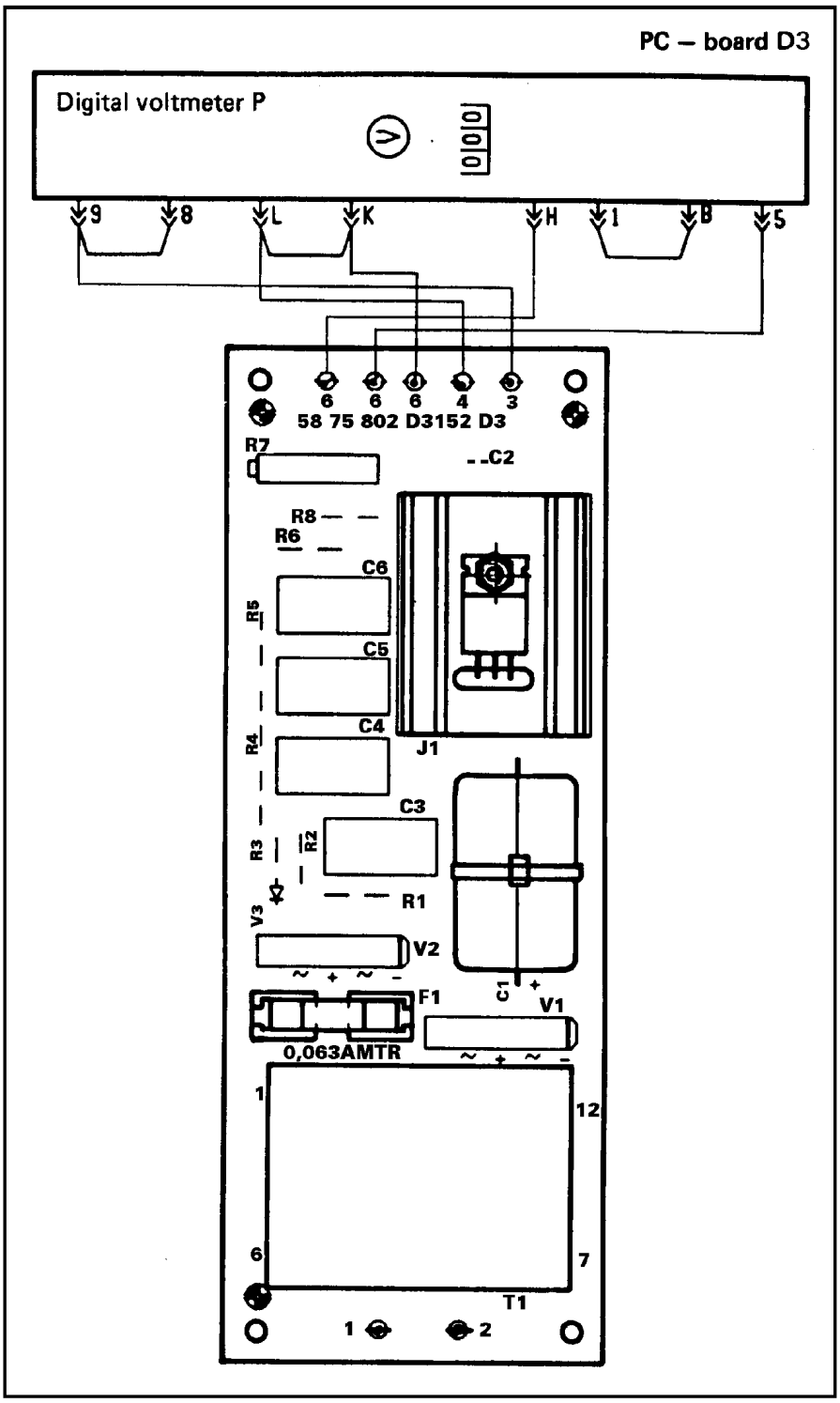

PC – board D3
Digital voltmeter P
9
8
L
K
H
I
B
5
6
6
6
4
3
58 75 802 D3152 D3
R7
C2
R8
R6
C6
R5
C5
C4
R4
J1
C3
R3
R2
R1
V3
V2
C1
V1
F1
0,063AMTR
1
12
6
7
T1
1
2

Figure 3-97

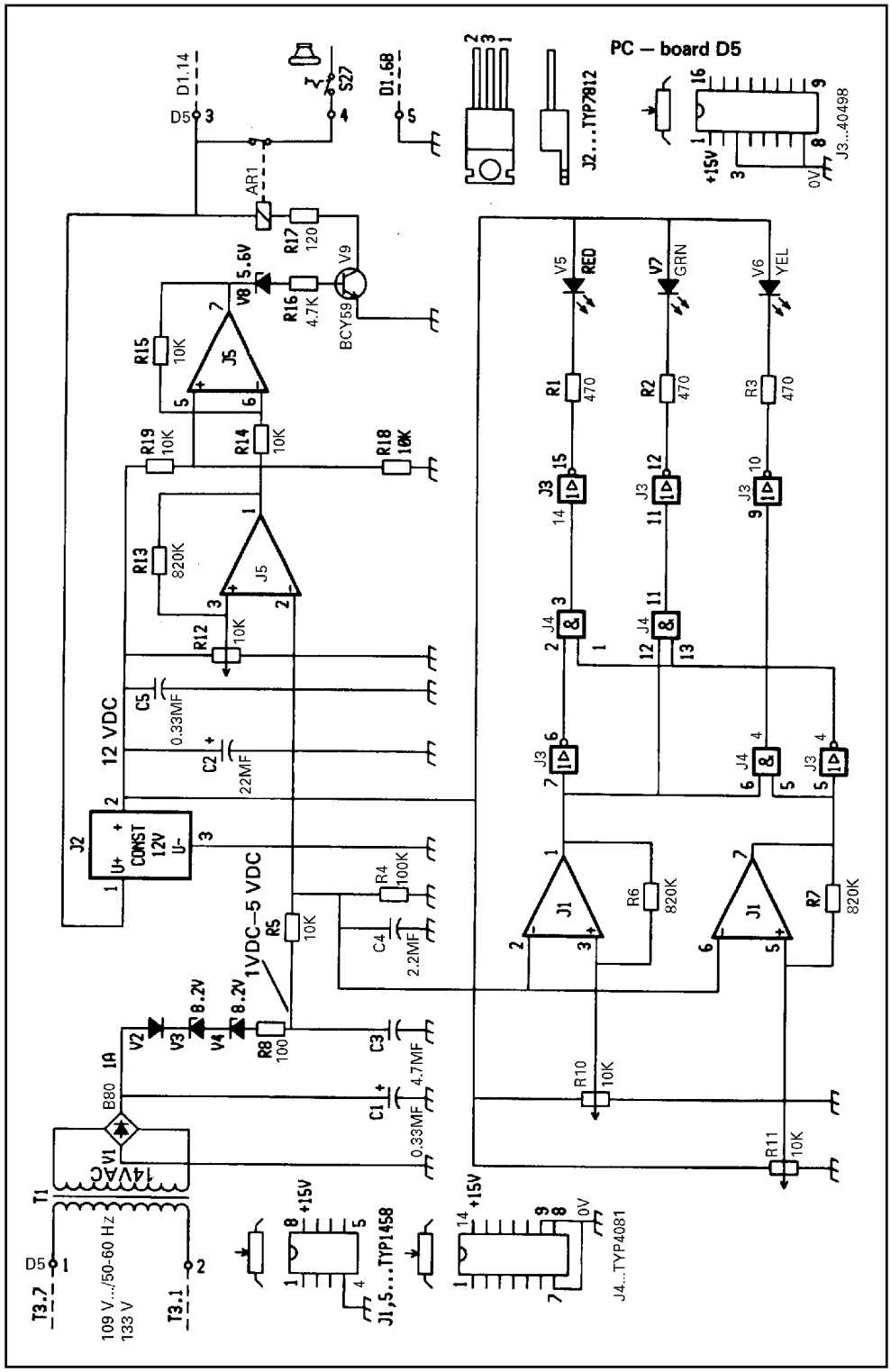

PC – board D5
J2...TYP7812
J3...40498
D1.14
D1.68
S27
AR1
R17 120
V9
BCY59
R15 4.7K
V8 5.6V
R15 10K
R19 10K
R14 10K
R18 10K
R13 820K
R12 10K
C5 0.33MF
C2 22MF
12 VDC
J2
CONST 12V
U+
U-
5 VDC
R5 10K
R4 100K
C4 2.2MF
C3 4.7MF
C1 0.33MF
R8 100
V2
V3
V4
8.2V
B80
1A
V1
14VAC
T1
D5
109 V.../50-60 Hz
133 V
T3.7
T3.1
J1,5...TYP1458
+15V
0V
J4...TYP4081
V5 RED
V7 GRN
V6 YEL
R1 470
R2 470
R3 470
R6 820K
R7 820K
R10 10K
R11 10K
J1
J3
J4
&

Figure 3-98

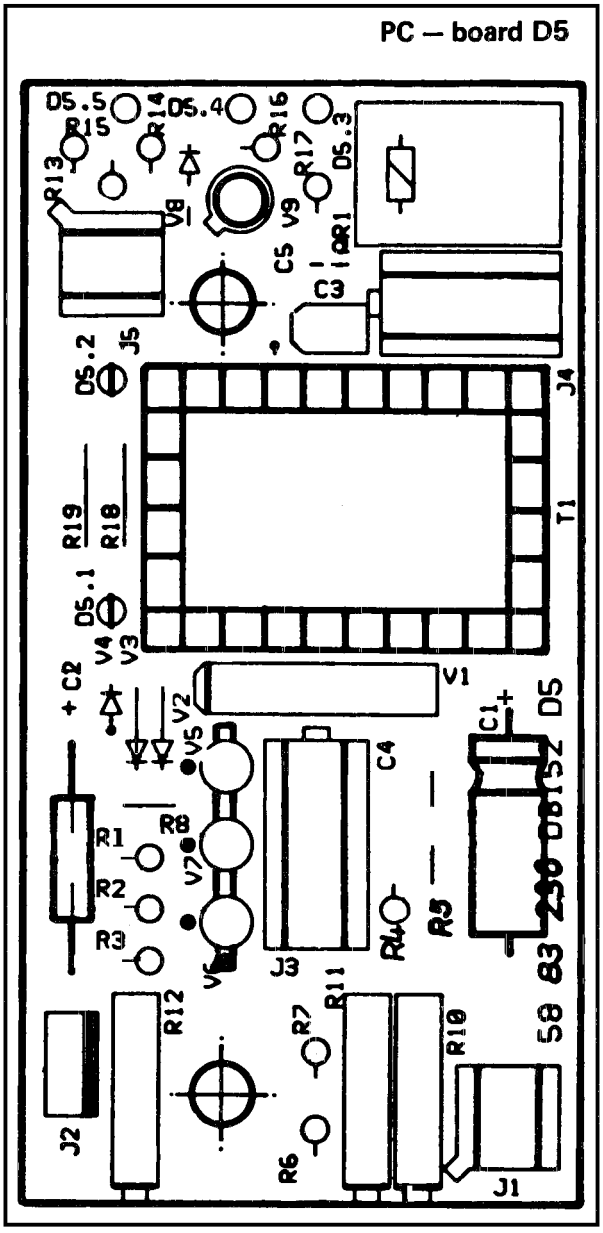

PC – board D5
D5.5
R15
R14
D5.4
R16
R17
D5.3
R13
V8
V9
C5
C3
D5.2
J5
J4
T1
R19
R18
D5.1
V4
V3
V1
+ C2
V2
V5
C1
D5
C4
R1
R8
R2
V2
R3
V6
J3
R4
R5
R12
R7
R11
R10
J2
R6
J1

Figure 3-99

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for the operator's description of the equipment's malfunction.	P	F
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.	P	F
3. Perform a visual inspection.	P	F
4. Perform a function check to confirm symptoms listed on DA Form 2407.	P	F
5. Troubleshoot and isolate the malfunction to component level.	P	F
6. Determine if the repair cost exceed the MEL.	P	F
7. Repair or replace the defective component.	P	F
8. Perform a function check.	P	F
9. Determine the disposition of the unit.	P	F
10. Complete DA Forms 2407 and 2409 IAW TB 38-750-2.	P	F

REFERENCES:	***Required***	***Related***
	Manufacturer's Service Literature TB 38-750-2 TB Med 7	AR 710-2 AR 40-61

081-874-0012

REPAIR A BLOOD RECOVERY UNIT TO COMPONENT LEVEL

CONDITIONS

You have received DA Form 2407 for repair of a blood recovery unit. Necessary materials and equipment: DA Form 2409, manufacturer's service literature (Chapters 2, 3.2.1, 4 and 8), tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's literature. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for the operator's description of the equipment's malfunction.	P	F
2. Determine maintenance expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain the current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart at Figure 3-100 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.

NOTE: Under certain conditions the MEL may be waived. (See TB Med 7.)

Performance Measures **Results**

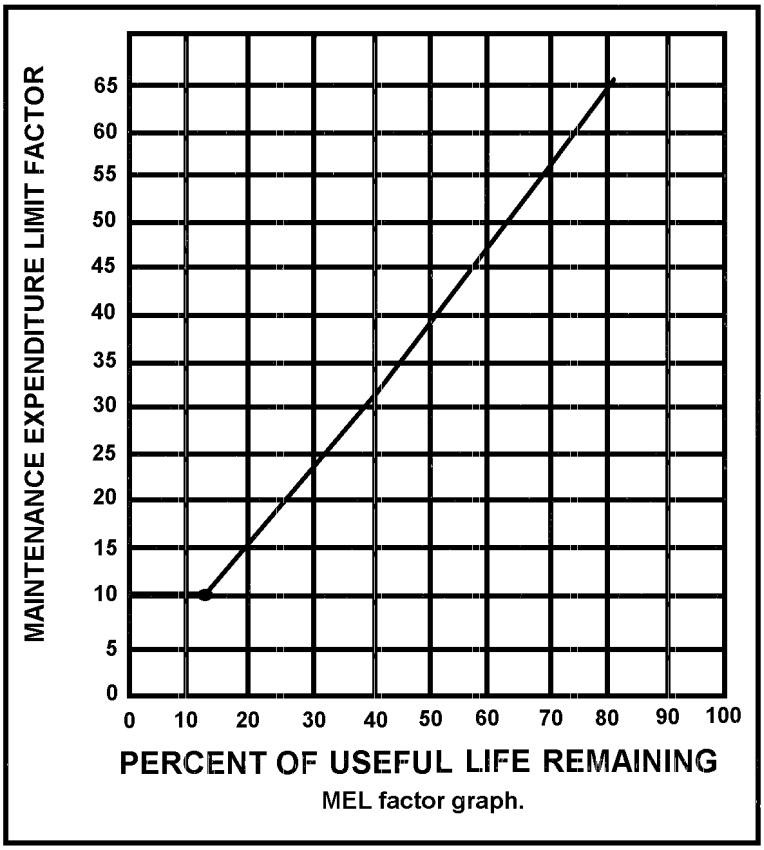


Figure 3-100

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 per cent. This MEL remains constant for as long as the equipment is in use, regardless of age.

3. Install post and bracket to raise the deck for access and troubleshooting. P F

a. Remove the deck mounting screws, 3 on each side and 4 on the rear.

b. Remove the top of the IV pole and install the deck support bracket onto the pole. Rotate the bracket to avoid an obstruction with the deck cover.

c. Lower the handle assembly and the IV pole to their lowest positions.

d. Lift the deck straight up and swivel the support bracket into the deck stand holder to support the rear of the deck assembly.

Performance Measures	Results	
e. Install the second deck support posts to the underside of the deck by screwing the posts into the holes located on the left and right underside of the deck.		
f. Lower the deck until these posts come to rest on the steps located on the inside of the cabinet on both sides.		
4. Visually inspect the unit for loose or missing components.	P	F
5. Perform a function check to confirm symptoms listed in DA Form 2407.	P	F
NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 12.)		
6. Troubleshoot and isolate the malfunction to modular level. (Refer to manufacturer's literature: Chapter 3.2.1- "Symptoms" and Chapter 4, "Software Diagnostics.")	P	F
7. Troubleshoot and isolate the malfunction to component level (refer to manufacturer's service literature, Chapters 2 and 8).	P	F
8. Determine if the repair cost exceeds the MEL.	P	F
NOTE: If the repair cost exceeds the MEL, notify the supervisor.		
9. Replace the malfunctioning module or circuit board.	P	F
10. Perform a function check.	P	F
11. Determine the disposition of the unit.	P	F
a. Prepare to release the unit to the user if the function check is satisfactory.		
b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.		
c. Refer to the next higher echelon of maintenance, if necessary.		
12. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P	F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.		
b. Obtain the user's signature for receipt of the unit, as appropriate.		

Performance Measures **Results**

c. Release the unit to the user.

REFERENCES:	***Required***	***Related***
	Manufacturer's Service Literature TB Med 7 TB 38-750-2	AR 40-61 AR 710-2

081-874-0022

REPAIR A REFRIGERATED TABLETOP CENTRIFUGE TO COMPONENT LEVEL

CONDITIONS

You have received DA Form 2407 for repair of a refrigerated tabletop centrifuge. Necessary materials and equipment: manufacturer's service literature, TB 38-750-2, DA Form 2409, TB Med 7, multimeter, oscilloscope, tool kit (medical maintenance organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's service literature. Results are recorded on DA Form 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for the operator's description of the equipment's malfunction.	P	F
2. Determine the expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain the current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart in Figure 3-101 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine the maximum allowable repair cost.

NOTE: Under certain conditions the MEL may be waived. (See TB Med 7.)

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long the equipment is in use, regardless of the age.

Performance Measures **Results**

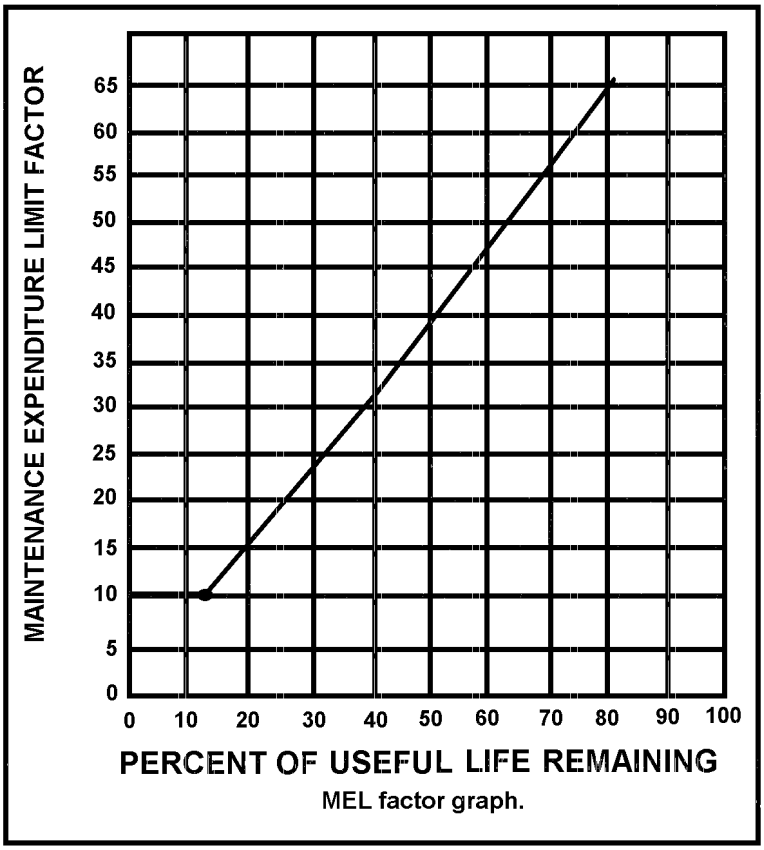


Figure 3-101

3. Inspect all external surfaces of the centrifuge for-- P F

   a. Physical damage.

   b. Breakage.

   c. Loose or dirty contacts.

   d. Missing components.

4. Perform a function check to confirm symptoms listed on DA Form 2407. P F

NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user.

Performance Measures	Results
5. Open the front panel.	P F
a. Inspect the circuit board surfaces for--	
(1) Discoloration.	
(2) Cracks.	
(3) Breaks.	
(4) Warps.	
b. Inspect the circuit board conductors for--	
(1) Cracks.	
(2) Breaks.	
(3) Cuts.	
(4) Erosion.	
(5) Looseness.	
c. Inspect all assemblies for burned or loose components.	
d. Inspect the chassis and panel mounted components for--	
(1) Looseness.	
(2) Breakage.	
(3) Loose contacts.	
(4) Loose conductors.	
e. Inspect for disconnected, broken, cut, loose, or frayed cables or wires.	
6. Troubleshoot and isolate the malfunction(s) to module/board level. (See Figures 3-102 and 3-103.)	P F

Performance Measures	Results
GENERAL TROUBLESHOOTING	
PROBLEM: Door will not open	
Is the power on?	If NO, turn power on or, if electrical failure, use mechanical interlock override when motor stops.
If YES, do instruments run?	If NO, and FAULT light is illuminated: (1) Use interlock override procedure and check for motor imbalance. (2) Belt malfunction. (3) Over/Under temperature.
If YES, connect 1 meter lead to J9-4 on motor control PC board and the other metal lead to ground (TP1). It should read 0-.8 VDC when door is open, and approximately 28 VDC when door is closed (with timer on and speed control on).	If NO, replace motor control PC board.
If YES, on motor control PC board, short out resistor R36. Solenoid will not energize and door light will stay illuminated all the time.	If NO, replace motor control PC board.
If YES, On motor control PC board, connect one meter lead to J8 pin 6 and the other lead to ground (TP1). Turn disc on motor to check tach input. Meter should read low AC voltage, then goes high.	If NO, replace motor control PC board.
If YES and interlock override not moving freely, check: (1) Clearance under interlock (obstruction). (2) Interference inside (around latch).	If NO, replace motor control PC board.

Figure 3-102

Performance Measures	Results

GENERAL TROUBLESHOOTING

PROBLEM: Power switch will not illuminate and no power is present.

Is centrifuge plugged in both at back of instrument and at wall receptacle?	If NO, plug centrifuge power cord into rear of instrument first, then into receptacle.
If YES, does power supply conform to power specification on back nameplate of instrument and does power supply function properly?	If NO, reset power supply circuit breaker or replace motor control PC board.
If NO, check voltage at circuit breaker (both entering and leaving). Does voltage exist after breaker?	If YES and if power switch does not illuminate, replace circuit breaker.
If NO, does power exist before breaker?	If YES, replace circuit breaker.
If NO, continue to take voltage and continuity checks, referring to system schematic.	

Figure 3-102 (Continued)

Performance Measures	Results
GENERAL TROUBLESHOOTING	
PROBLEM: Instrument will not start.	
Is door latched properly?	If NO, turn the door release fully clockwise. Turn the time control to OFF and wait for open light to illuminate. Engage the door latches by turning doorknob fully counterclockwise. Set timer control. If YES, (1) Check rotor contents for imbalance. Check that table is reasonably level and that centrifuge has been leveled accordingly. (2) Belt malfunction-check belt switch (S5). (3) Over/Under temperature-check temperature meter.
If NO, with timer on check voltage across coil of K1. Is voltage 24DC?	If NO, and no voltage at all, check connections; if voltage is present but K1 does not energize, replace relay.
If YES, with timer on K1 energized, check voltage across TB2-3 and TB2-5 on motor control PC board. Is voltage 120VAC?	If NO, and no voltage at all, check connections; if voltage is present but too low, replace motor control PC board.

Figure 3-102 (Continued)

Performance Measures **Results**

GENERAL TROUBLESHOOTING

PROBLEM: Instrument will not start. (Cont'd)

If YES, add two jumpers to motor control PC board: one from the base of Q2 to ground (TP1), the other from pin 5 of Z5 to the common point between R61 and R62 (to jump slow start). Does centrifuge go right up to speed without slow start?	If NO, replace motor control PC board.
If YES, check: (1) Motor wiring and connections (2) Motor field winding resistance: approx 2 ohms	

Figure 3-102 (Continued)

Performance Measures	Results
GENERAL TROUBLESHOOTING	
PROBLEM: Refrigeration system unable to provide desired temperature.	
Check condenser fins. Do they need cleaning?	If YES, clean condenser fins.
If NO, check rotor chamber. Does it need to be defrosted?	If YES, defrost rotor chamber.
If NO, are minimum clearances maintained on all sides of the centrifuge?	If NO, reposition instrument.
If YES, is compressor fan functioning?	If NO, check electrical connection; replace fan and/or motor.
If YES, is door fitting tight?	If NO, check door seal; replace seal.
If YES, check calibration of temperature meter. Is meter calibrated?	If NO, calibrate temperature meter.
If YES, check line voltage. Is voltage 90% of nameplate rating?	If NO, have power supply corrected.
If YES, check the start capacitor, start relay and thermal protector. Do components function properly?	If NO, replace defective component.
If YES, check sight glass. Is the amount of Freon correct?	If NO, fill system until correct amount of Freon 12 is attained.
If YES, are the fittings tight? Is insulation adequate?	If NO, tighten fittings. Insulate where required.

Figure 3-102 (Continued)

Performance Measures **Results**

GENERAL TROUBLESHOOTING	
PROBLEM: Refrigeration system unable to provide desired temperature. (Cont'd)	
If YES, on temperature control PC board, connect meter lead to collector of Q2 and other to ground (TP1). With power on and timer set, rotate temperature control knob below temperature meter reading. Voltmeter should start light and then go low (compressor would go on), then go back light (when compressor goes off). Does it?	If NO, replace temperature control PC board.
If YES, on temperature control PC board, connect meter lead to pin 1 of TB1 and other lead to pin 2 of TB1. Reading should be 120V when compressor is off; then approximately 1-2V when compressor goes on. Are readings correct?	If NO, replace temperature control PC board.

Figure 3-102 (Continued)

7. Determine if the repair cost exceeds the MEL. P F

NOTE: If the repair cost exceeds the MEL, notify the supervisor.

8. Replace the malfunctioning component. P F

9. Perform a function check. P F

10. Determine the disposition of the unit. P F

a. Prepare to release the unit to the user if the function check is satisfactory.

b. Take the unit out of service if uncorrected deficiencies are present, and they present a danger to patients or operator or if the machine could be damaged due to continued use.

Performance Measures **Results**

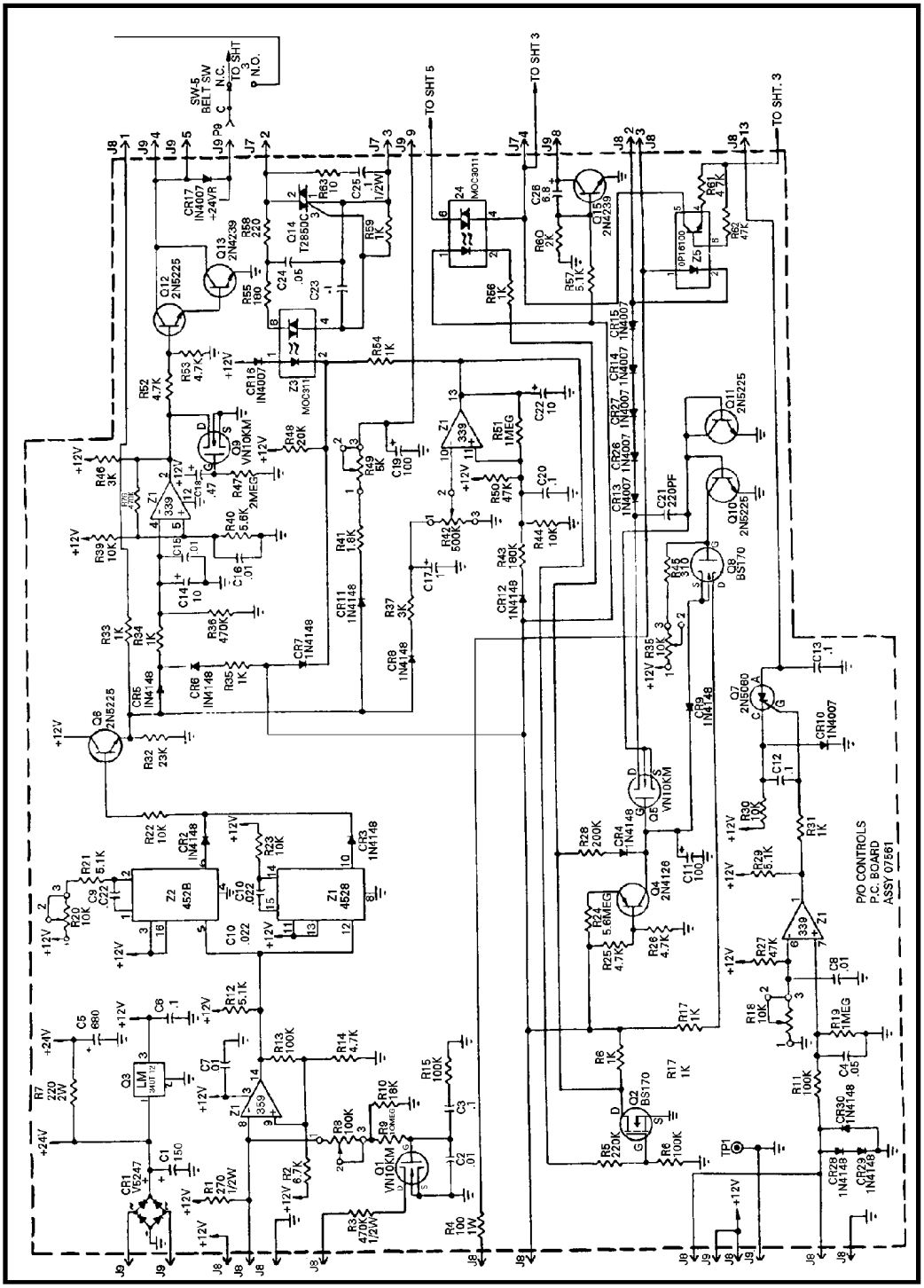


Figure 3-103

Performance Measures	Results
c. Refer to the next higher echelon of maintenance, if necessary.	
11. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.	
b. Obtain the user's signature for receipt of the unit, as appropriate.	
c. Release the unit to the user.	

REFERENCES:	*Required*	*Related*
	Manufacturer's Service Literature TB MED 7 TB 38-750-2	AR 40-61 AR 710-2

081-874-0026

REPAIR A MONITOR-RECORDER TO COMPONENT LEVEL

CONDITIONS

You have received DA Form 2407 for repair of monitor-recorder. Necessary materials and equipment: manufacturer's service literature, DA Form 2409, TB Med 7, TB 38-750-2, digital multimeter, oscilloscope with probes (25MZ bandwidth, dual trace), patient ECG simulator (output level 1mv, range 60 to 120 bpm normal sinus rhythm), signal generator (sinewave, 1 to 5 Vp-p at 5 Hz), logic probe, tool kits (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's service literature. Results are recorded on DA Form 2407 and 2409.

TRAINING/EVALUATION

Training Information Outline

1. Review DA Form 2407 for operator's description of the equipment malfunction.

2. Determine the maintenance expenditure limits (MEL) for definite life equipment.

   a. Obtain the current replacement cost.

   b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

   c. Use the chart at Figure 3-104 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the base line.

   d. Project a horizontal line to the MEL factor.

   e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair cost.

NOTE: Under certain conditions the MEL may be waived. (See TB Med 7.)

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is 10%. This MEL remains constant for as long as the equipment is in use, regardless of age.

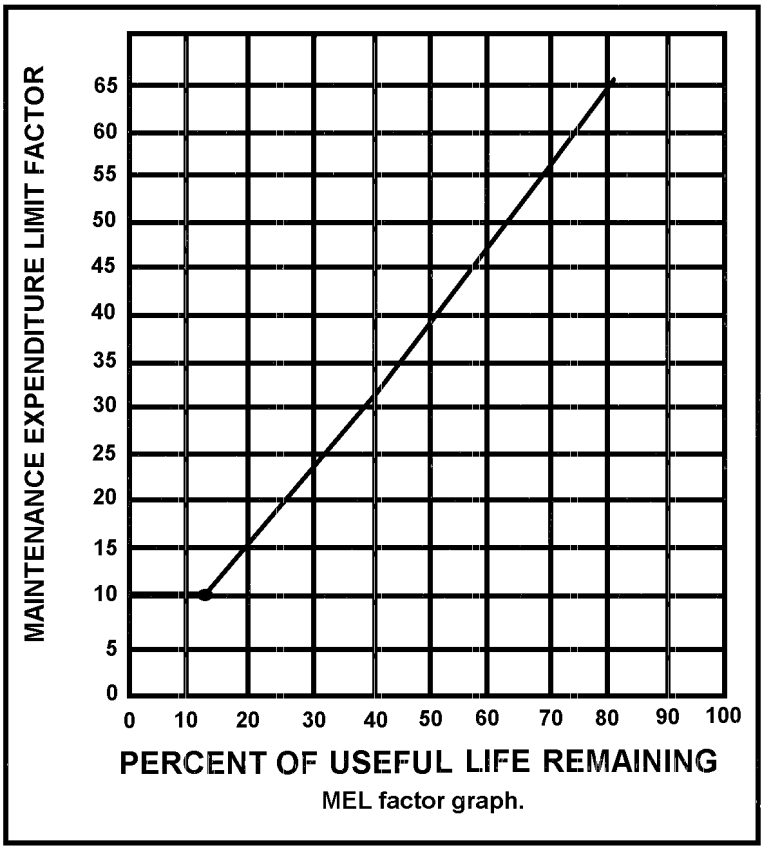


Figure 3-104

3. Inspect all external surfaces of the monitor-recorder for--

   a. Physical damage.

   b. Breakage.

   c. Loose or dirty contacts.

   d. Missing components.

4. Perform a function check to confirm symptoms listed on DA Form 2407.

NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 13.)

5. Place the monitor-recorder in the service mode.

a. Press the POWER OFF key.

b. Press and hold the RIGHT and LEFT arrow keys, press the POWER ON key, then immediately press the SELECT key. Release the RIGHT and LEFT keys. Verify the CRT screen shows a ramp waveform followed by a stair step waveform. Verify the presence of audio tone (beeping).

c. Press the SELECT key until the beeper indicator is on.

d. Press the UP and DOWN arrow keys simultaneously until "Batt xx.xV" is displayed on the screen.

e. Press the up and down arrow keys simultaneously until "Gain xxxx a" is displayed on the CRT screen. To change gain, press the SELECT key until ECG size indicator is on. Press the UP and DOWN keys until the desired gain is displayed on the CRT screen.

f. Verify the beeper indicator is on. Press the UP and DOWN arrow keys simultaneously until "Noise xx.xV" is displayed on the CRT screen.

g. Verify the beeper indicator is on. Press the UP and DOWN arrow keys simultaneously until "Offset xx.xV" is displayed on the CRT screen.

h. Verify the beeper indicator is on. Press the UP and DOWN arrow keys simultaneously until "IR link xxx" is displayed on the CRT screen.

i. Verify the beeper indicator in on. Press the UP and DOWN arrow keys simultaneously until "LFREQ xx HZ" is displayed on the CRT screen.

j. Exit the service mode by pressing the POWER OFF key.

6. Read and interpret the error messages. (See Figure 3-105.)

ERROR MESSAGES

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
CRT displays "error 0."	Main controller (A2A2U61) error.	See system dead problems.
CRT displays "error 1."	Recorder-controller error.	A2A2U1 (RAM/ROM).
CRT displays "error 2."	CRT and display controller error.	A2A2U31 (RAM/ROM).
CRT displays "error 3."	ECG memory error.	A2A4 ECG memory CCA.
CRT displays "error 6."	LV supply out of specification.	See low voltage supply problems.
CRT displays "error 7."	A/D converter	See system dead problems.
CRT displays "error 8."	Recorder motor failure.	See recorder problems.

Figure 3-105

7. Remove the monitor-recorder from the case.

CAUTION

The monitor-recorder module contains high voltages. After the power is removed, discharge capacitors to ground before working inside to prevent electrical shock. Disconnecting the AC power cord will not remove all dangerous voltages. The monitor-recorder module operates from battery as well as AC power.

CAUTION

Do not disconnect or remove any board assemblies in the monitor-recorder module unless the power is off. Some board assemblies contain devices that can be damaged if the board is removed when the power is on. Several components, including metal-oxide semiconductors (MOS) devices, can be damaged by electrostatic discharge. Use conductive foam and grounding straps when servicing is required around sensitive components. Use care when unplugging integrated circuits (IC's) from high-grip sockets.

a. Inspect the circuit board surfaces for--

(1) Discoloration.

(2) Cracks.

(3) Breaks.

(4) Warps.

b. Inspect the circuit board conductors for--

(1) Cracks.

(2) Breaks.

(3) Cuts.

(4) Corrosion.

(5) Looseness.

c. Inspect all assemblies for burned or loose component.

d. Inspect all the chassis and panel mounted components for looseness, breakage, or loose contacts or conductors.

e. Inspect for disconnected, broken, cut, loose, or frayed cables or wires.

8. Troubleshoot and isolate the malfunction(s) to component level. (See Figure 3-106, General troubleshooting.)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
System dead.	Power.	Check battery voltage at A2A3J2 pins 8 and 9.
		Check for +14.3 V at A2A3J2 pins 2 and 3 when AC power cord is connected to AC source and BT1 is fully charged.
	A3A2 POWER ON switch.	Check for continuity between A2A2J33 pin 11 and pin 14 (DGND) when POWER ON key is pressed.
		Check for continuity between A2A3J30 pin 2 and pin 6 (DGND) when POWER ON key is pressed.
	A2A3K102.	Use a jumper wire to force ±12V across the coil and verify the relay operates (clicks). If A2A3K102 is closed, the instrument should be on.
	A2A3U102.	Verify A2A3U102 pin 1 is low impedance when pin 8 is greater than 2.5 V above pin 6.
	A2A3F101.	Check fuse.

Figure 3-106

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Instrument will only stay on while the ON switch is held.	A3A2Q1.	+5V FP should hold A3A2Q1 on, forcing the ON/OFF signal to ground.
V battery, +8V, +5V, and -5V are correct, but instrument will not turn on.	Clock Oscillator ON A2A2.	Check A2A2U62 pins 7 and 8 for 12 MHz sine wave with 5V amplitude. Check A2A2U62 pin 9 and A2A2U61 pin 19 for 12 MHz square wave with 5V amplitude.
Continuous tone, with no CRT display.	A2A2U61.	Check Vcc onA2A2U62 pins 18 and 68 for greater than 4.3V. Check A2A2U61 pin 40 for 4.7 to 5.3V. Check A2A2U63 pin 20 for 4.9 to 5.1V. Check A2A2U62 pin 2 for 0 to 5V signal, with period of 4.167ms (240 Hz) and 30% duty cycle. Check A2A2U61 pin 9 for reset signal.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Continuous tone, with no CRT display. (Cont'd)	A2A2U61. (Cont'd)	Check for pins being stuck, low, or disconnected on external address/data bus. A2A2U61 pins 32 thru 39, A2A2A2U62 pins 10,12, thru 14,16,17,21,22,and A2A2U63 pins 9,11 thru 17 should be active.
		Check ALE signal between A2A2U61 pin 30 and U62 pin 4. Should be 2 MHz square wave with 300ns logic high pulse.
Unit turns on but no "READY" message and no power up tone.	A2A2U62.	Check signal on A2A2C70 and A2A2U62 pin 3 during turn on. Should take several hundred milliseconds to charge to Vcc.
Unit turn on, CRT display frozen with "ERROR 0", may or may not continuous tone.	A2A2U61.	Check "tickle" signal A2A2U62 pin 2 and "RESET" signal A2A2U61 pin 9.
Characters short.	+8 volt supply reference.	See "Flat trace."
	-5 volt supply.	Check A2A2U34 pin 3 and A2A2U35 pin 4 for -5V.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Characters short.	+8 volt supply reference.	See "Flat trace."
	-5 volt supply.	Check A2A2U34 pin 3 and A2A2U35 pin 4 for -5V.
Too bright or dim.	A2A2R35 and R37.	Check A2A2 R35 and R37 for proper value.
Display jumps.	+5 Volts supply.	Check the +5 Volts for noise.
	Horizontal sweep signal.	Check A2A2U31 pin 7 for undistorted square wave.
No sync marker.	A2A2U33.	Check A2A2U33 pin 19 for syc pulse. Check A2A2R35 for proper value.
Character dots jitter.	A2A5 Vertical Deflection.	Check A2A2U35 pin 7 for the same waveform as shown on the CRT. Must be in service mode.
		If OK, Check A2A5U2 pins 5 and, 7 and A2A5U1 pins 8 and 14 for jitter on miniraster position of trace.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Character dots jitter. (Cont'd)	A2A2C40 (damping).	Check for proper value of A2A2C40.
	A2A2 voltage reference.	VREF2 (A2A2C39/R32) for stable 5V.
Display baseline no characters.	A2A5 Vertical Deflection.	Check A2A2U35 pin 7 for same waveforms as shown on the CRT. Must be in the service mode.
		If OK, check A2A5U2 pins 5 and, 7 and A2A5U1 pins 8 and 14.
	A2L1 Deflection Yoke.	Check A2L1 resistance approximately 6 ohms vertical and 40 ohms horizontal.
	+8V supply.	Check A2A2U35 pin 8 for +8V.
	A2A2 voltage reference.	Check VREF2 (A2A2C39/R32) equal to +5V.
Characters short.	-5 volt supply.	Check A2A2J31 pin 2, A2A2U34 pin 3 and A2A2U35 pin 4 for -5v.
	A2A2 voltage reference.	Check VREF2 (A2A2C39/R32) equal to +5V.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Display blank.	A2A5ZZ2.	Check A2A5ZZ2 +40V and +100V test points. Check A2A2U35 pin 4 for -5V.
	A2A2U33.	Check for A2A2U33 pin 18 for intensity waveform.
	A2A2U31.	Check the intensity control signal from the processor A2A2U31 pin 13 and 14. If either is stuck high or low, suspect A2A2U31. If they are toggling, suspect A2A2U33.
	Intensity circuit, tube filament.	Check junction of A2A5DS1/R31 for waveform. Check for filament current by plugging instrument in and measuring voltage drop across A2A5R32.
Too Bright or too dim.	See "Display Blank."	
Intensity varies.	A2A5ZZ2.	Check A2A5ZZ2 +40V and +100V test points.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Left side of display different size than right side.	A2A5Q1 to Q4, U1.	Check base voltages on A2A5Q1 to Q4. If there is no Signal, suspect A2A5U1; otherwise, suspect A2A5Q1 and Q4 for right side problems, and A2A5Q2 and Q3 for left side problems.
Top half of display is different size than bottom half.	A2A5Q5 to Q8, U1.	Check the base voltages on A2A5Q5 to Q8. If there is no signal, suspect A2A5U1. Otherwise, suspect A2A5Q5 and Q8 for upper half problems, and A2A5Q6 and Q7 for bottom half problems.
Vertical deflection shakes.	A2A5R25.	Check A2A5U2 pin 7. If it's not stable, replace A2A25U2. If OK, verify the value of A2A5R25.
No ECG.	A2A2U31.	Check bus A2A2U31 pins 32 to 39 for activity. If none, suspect A2A2U31.
No ECG-letters OK.	A2A2U33.	Check all soldering joints on A2A2U33.
	A2A5U31.	Check bus on A2A5U31 pin 32 to 39.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Flat trace-no characters.	+8 volt supply.	A2A2U35 pin 8 for +8V. Check A2A2U34 pin 13 for +8V.
	A2A2 voltage reference.	Check VREF2 (A2A2C39/R32) +5V.
False "No paper" message.	Paper rotating on spindle.	Paper core inner diameter too large (improper paper). Use P/N 40453A.
	A2A2R15, A3A1A2P4 pin 38.	4ms low pulse every 32 ms.
	A2A2U3 pin 5.	Signal active every 32ms.
No paper shut off.	A2A2U3 pin 5, A3A1A2R1, R2.	Signal level remains constant when A2A2Q5 turns on.
Will not run.	A2A2U1 pin 27, A2A2U3 pin10, A3A1A2C2.	1 kHz signal variable duty cycle present.
	A3A1 motor.	Interrupter on the rear of the motor shaft turning freely.
	A3A1A3 front panel switch.	Signal not reaching A2A2U1.
Erratic speed.	A2A2U3 pin 2, A2A1A2R3.	3.974 kHz signal 50% duty cycle present.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Runs for short period then shuts off (doesn't detect paper).	No paper.	Replace paper roll.
	A2A2Q5.	On every 32 ms for 4 ms.
	A2A2U3 pin 5.	Change when A2A2Q5 turn on.
	A3A1A2R1 and R2.	Verify current flows when A2A2Q5 turns on.
	Optodetector, A2A2U3 pin 5 and 6, A2A2Q5.	Clean lens.
Printing light or missing top or bottom half.	A3A1 printhead.	Adjust printhead.
No printing.	A2A2U3 pin 4 A3A1A2P4 pin 10.	Alternating high-low signal every 250-1000 usec.
Light printing.	A3A1 printhead.	Needs cleaning.
	Battery low. (<11.2 V).	Check voltage. Troubleshoot low battery shutdown circuit.
	Improper paper.	Use P/N 40453A.
	Door.	Door not closing completely.
50/60 Hz noise on ECG trace.	Electromagnetically noisy environment.	Check grounding of nearby equipment.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
50/60 Hz noise on ECG trace. (Cont'd)	High electrode impedance.	Use Redux (P/N 651-1024-050) creme, abrade skin.
	Patient cable.	Substitute another patient cable.
ECG noise, not 50/60 Hz.	A2A3 isolated circuits.	Short across A2A3T201 pins 1 and 2 and observe.
		Short across A2A3C207 and observe.
		Short A2A3U205 pin 3 to A2A3U206 pin 3 and observe.
		Short A2A3R205, R208, R211, and R214 and observe.
	A2A3 grounded circuits.	A2A3U304 pin 1 to ground and observe.
		Short junction of A2A3R312 and R313 to ground and observe.
		Short A2A3U302 pin 3 to ground and observe.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
ECG Amp does not meet 0.5Hz bandwidth spec.	A2A3C302, R303 to R305.	Verify component values.
	A2A3Q301, Q302.	FAST RESTORE A2A3J30 pin 16 should normally be low. A2A3Q302 and Q301 are normally OFF.
Leads ECG offset from center displays.	A2A3R308.	Adjust ECG offset.
	A2A3U302.	Verify offset voltage is < 0.5 mV, and or input bias current is < 50 pA on A2A3U302 pin 3.
ECG Gain Incorrect.	A2A3R311.	Adjust ECG gain.
	A2A3U303.	Measure ON resistance for each of eight multiplexer channels.
Will not enter Service mode.	A2A2 Control CCA.	
	A3A1A3 LEFT/RIGHT arrow key.	Check for switch continuity (A3A1A3P42 pin 9 to 7, and 4 to 5).
No service ramp-step waveform on CRT or recorder.	A2A2U61.	
Ramp waveform is nonlinear.	A2A5 CRT Deflection CCA.	

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Battery not charging, but LED is on.	BT1 Thermal Fuse.	Verify continuity between red and white wires (BT1P14 pins 1 and 3).
	BT1 Battery assembly.	Check open circuit battery volts. Load test battery.
Battery not charging, LED is off, AC is connected.	A2A1 Power Supply CCA.	Verify 12 to 14.5 V at A2A3J2 pin 3 when AC is connected.
	A2A3K101.	Verify A2A3K101 is closed when AC is connected and open when AC disconnected (audible click).
	A2A3U101.	Verify A2A3U101 pin 1 is high when AC is connected.
	A2A3Q101.	Verify A2A3Q101 gate is high and transistor is conducting when AC is connected.
Battery Charging LED not working.	A2A3U101.	A2A3U101 pin 7 should be low when AC is connected and battery is normal.
	A2A3Q102.	A2A3Q102 should be on when battery is charging. Trace signal path out to A3A2DS6.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Low battery shutdown not occurring. Unit does not turn off when battery is below 11V.	A2A3U102.	A2A3U102 should allow current to flow into pin 1 when pin 8 is 2.5V above pin 6; otherwise, no current flows into pin 1.
	BT1 Battery Assembly.	If battery was discharged below 10.8 volts, capacity may not recover. Replace BT1.
+8V supply not operating correctly.	A2A3U103.	11 to 14 V on A2A3U103 pin 3.
+5V supply not operating correctly.	A2A3U104.	Square wave switching occurring on A2A3U104 pin 2.
-5V supply not operating correctly.	A2A3 +5V circuit.	Verify adequate load on +5V so that duty cycle at A2A3U104 pin 2 is not too short to allow charge pump to store charge on A2A3C110.
	A2A3U105.	Verify A2A3U105 pin 3 more negative then -8V.

Figure 3-106 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
"NO DEFIB", No communication between monitor-recorder and defibrillator module.	Optical window.	Clean the optical window on both instruments and check for scratches.
		Try a different defibrillator and a different monitor-recorder.
		Put the unit in service mode and read number of optical link errors reported by message. IR Link O errors is normal.
	A2A2 control circuit card assembly (CCA).	Verify activity on IR TRANSMIT signal line A1A1P36 pin 4.
	A1A1U2, Q1, DS3.	Verify activity by tracing signals along the path of this component.
	A1A1U1, U2.	Verify receive signal activity at collator of A1A1U1E pin 1 and output of A1A1U2B pin 7.

Figure 3-106 (Continued)

9. Determine if the repair cost exceeds the MEL.

NOTE: If the repair costs exceeds the MEL, notify the supervisor.

10. Repair or replace the malfunctioning component.

11. Perform a function check.

12. Determine the disposition of the unit.

    a. Prepare to release the unit to the user if the functional check is satisfactory.

    b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.

    c. Refer to the next higher echelon of maintenance, if necessary.

13. Complete and file DA Form 2407 and 2409 IAW TB 39-750-2.

    a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.

    b. Obtain the user's signature for receipt of the unit, as appropriate.

    c. Release the unit to the user.

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for the operator's description of the equipment malfunction.	P	F
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.	P	F
3. Inspect all external surfaces of the monitor-recorder.	P	F
4. Perform a function check to confirm symptoms listed on DA Form 2407.	P	F
5. Place the monitor-recorder in the service mode.	P	F
6. Read and interpret the error messages.	P	F
7. Remove the monitor-recorder from the case.	P	F
8. Troubleshoot and isolate the malfunction(s) to component level.	P	F
9. Determine if the repair cost exceeds the MEL.	P	F
10. Repair or replace the defective component.	P	F
11. Perform a function check.	P	F

Performance Measures	Results
12. Determine the disposition of the unit.	P F
13. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P F

REFERENCES:	*Required*	*Related*
	Manufacturer's Service Literature TB Med 7 TB 38-750-2	AR 40-61 AR 710-

081-874-0030

REPAIR A DEFIBRILLATOR MODULE TO COMPONENT LEVEL

CONDITION

You have received a DA Form 2407 to repair a defibrillator module. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, manufacturer's service literature, digital multimeter, energy meter, stop watch, patient ECG simulator, safety analyzer, signal generator, tool kits, (medical equipment organizational maintenance), and individual tool box.

STANDARD

The malfunction is isolated to component level and corrected. The defibrillator is functional in accordance with operational standards specified in the manufacturer's service literature. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Training Information Outline

1. Review DA Form 2407 for operator's description of the equipment malfunction.

2. Determine the maintenance expenditure limits (MEL) for definite life equipment.

   a. Obtain the current replacement cost.

   b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

   c. Use the chart at Figure 3-107 to determine the MEL factor. Read up vertically from the percent of the useful life remaining to a point of intersection with the base line.

   d. Project a horizontal line to the MEL factor.

   e. Multiply the MEL factor by the current replacement cost to determine the maximum allowable repair cost.

NOTE: Under certain conditions the MEL may be waived. (See TB Med 7.)

NOTE: The MEL for definite life equipment which has reached or exceed its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

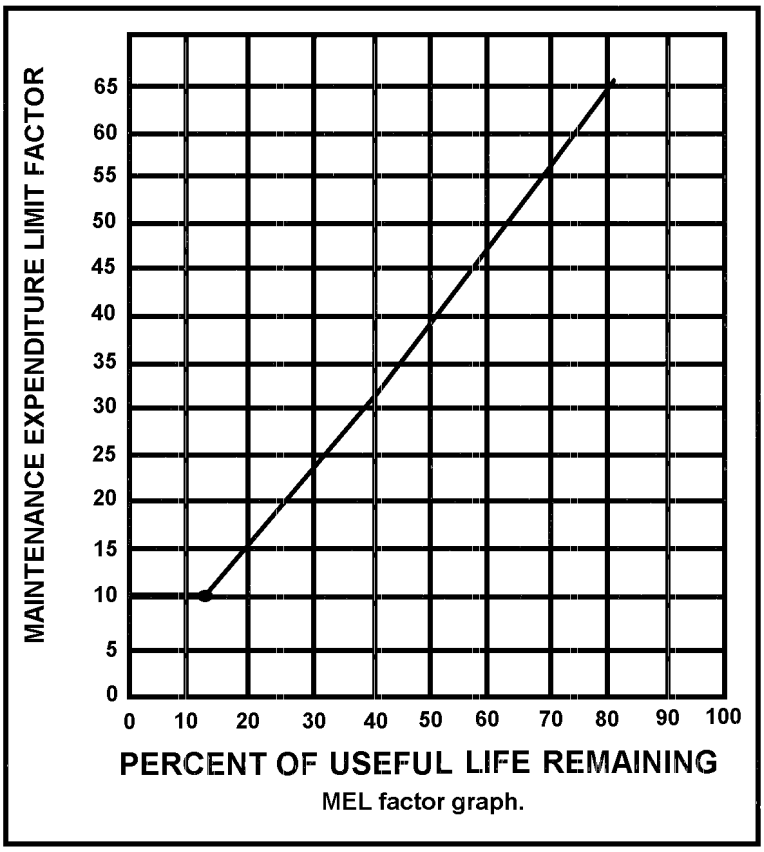
3. Inspect all external surfaces of the defibrillator for--

a. Physical damage.

b. Breakage.

c. Loose or dirty contacts.

d. Missing components.



MEL factor graph.

Figure 3-107

4. Perform a function check to confirm symptoms listed on DA Form 2407.

NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user.

5. Read and interpret the error messages. (See Figure 3-108.)

6. Remove the defibrillator from the case.

ERROR MESSAGES

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Display flashes "E2."	Defibrillator charging too slowly.	See defibrillator problems.
Display flashes "E3."	Defibrillator capacitor arcing.	See defibrillator problems.
Display flashes "E4."	Defibrillator charged but shouldn't be.	See defibrillator problems.
Display flashes "E5."	Defibrillator overcharged.	See defibrillator problems.
Display flashes "E6."	LV Supply out of spec.	See low voltage supply problems.
Display flashes "E7."	A/D (A2AU102) won't respond.	See system dead problems.
Display flashes "E8."	Microcontroller A2A2U101 failed power up R0M test.	
Display flashes "EEE."	A1A1 infrared link.	Verify monitor-recorder module is turned on and properly connected.

Figure 3-108

CAUTION

Disconnect the defibrillator from the AC power source before proceeding. This unit is battery powered, causing dangerous voltages to be present even with the AC power source removed.

a. Inspect the circuit board surfaces for--

(1) Discoloration.

(2) Cracks.

(3) Breaks.

(4) Warps.

b. Inspect the circuit board conductors for--

(1) Cracks.

(2) Breaks.

(3) Cuts.

(4) Corrosion.

(5) Looseness.

c. Inspect all assemblies for burned or loose components.

d. Inspect all the chassis and panel mounted components for--

(1) Looseness.

(2) Breakage.

(3) Loose contacts.

(4) Loose conductors.

e. Inspect for disconnected, broken, cut, loose, or frayed cables or wires.

7. Troubleshoot and isolate the malfunction(s) to component level. (See Figure 3-109.)

8. Determine if the repair cost exceeds the MEL.

NOTE: If the repair cost exceeds the MEL, notify the supervisor.

9. Repair or replace the malfunctioning component.

10. Perform a function check.

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
System dead.	Power.	Check battery voltage at A2A2P12
		Check for +14 .3 V at A2A2P13 when the AC power cord is connected source.
	A3A4 Power on switch.	Check for continuity between A2A2J2 pin 2 and pin 7 (GND) when Power On key is pressed.
	A2A3K402.	Use a jumper wire to force +12v across coil and verify relay operates (click). If A2A3K102 is closed, instrument should be on.
	A2A2U402.	Verify A2A2U402 pin 1 is low impedance when pin 8 is greater than 2.5 V above pin 6.
	A2A3F401.	Check Fuse.
Instrument will only stay on while ON switch is held.	A2A2Q201.	+5V should hold A2A2Q201 on forcing the ON/OFF signal to ground.
V battery, +8V, +5V - 5V correct, but instrument is not on.	Clock Oscillator on A2A2.	Check A2A2U103 pins 7 and 8 for 12 MHz sine wave, with 5V amplitude.

Figure 3-109

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Same symptoms as above with or without a continuous power up. Tone and display.	A2A2U101 or U103.	Check Vcc on A2A2U103 pins 18 and 68 for >4.5V. Check A2A2U101 pin 40 for Vcc of 4.7 to 5.3V. Check A2A2U102 pin 20 for Vcc of 4.9 to 5.1V. Check A2A2U103 pin 2. This is the decoded "tickle" signal from A2A2U101. Signal should be a CMOS logic level signal with a period of 4.167ms (240Hz) and approximate 40% duty cycle. Check A2A2U101 pin 9 for a positive reset signal. Check for pins being stuck, high, low, or disconnected on external address/data bus. A2A2U101 pins 32 thru 39; A2A2U103 pins 10, 12 13, 14, 16, 17, 21, and 22; and A2A2U102 pins 9, 11 thru 17 should be active.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Same symptoms as above with or without continuous power up. Tone and display. (Cont'd)	A2A2U101 or U103. (Cont'd)	Check WR signal between A2A2U101 pin 16 and A2A2U103 pin 5. Normally high with narrow low going strobes. Check ALE signal between A2A2U101 pin 30 and A2A2U103 pin 4. Should be 2 Mhz square wave with 300 ns high pulse. Check signal on A2A2C107 and A2A2U103 pin 3 during turn on. Should take several hundred milliseconds to charge to Vcc.
Unit will not respond to Apex paddle charge button.	A3A1 Apex paddle.	Verify continuity between A2A2J7 pins 1 and 5 when charge button is pressed.
	A2A2U105 or U101.	Verify A2A2U105 pin 2 is logic low when charge button is pressed and logic high when release.
Unit will not respond to front panel Energy Select/Charge keys.	A2A2U205.	Verify logic low on appropriate A2A2U205 pin 3,4, 11-14 when switch is pressed.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Unit will not respond to front panel Energy Select/Charge keys. (Cont'd)	A2A2U205. (Cont'd)	Verify shift activity every 4 msec when U101 activates FPSER CLK (A2A2U205 pin 2).
Unit does not respond to discharge switches.	A3A2 sternum paddle.	Verify continuity between A2A2J8 pins 1 and 3 when discharge switch is pressed.
	A3A1 Apex paddle.	Verify continuity between A2A2J7 pins 1 and 3 when discharge switch is pressed.
	A2A2U105.	Verify A2A2U105 pin 4 is a logic low when both discharge switches are pressed and a logic high otherwise.
	A2A2U106, U103, and U101.	Verify A2A2U106 pin 3 goes high when a discharge is requested and a logic low otherwise.
The defibrillator does not seem to charge. The display indicates 0 joules, then in a few seconds displays "EH" and aborts charge.	A. The defibrillator is charging, but the capacitor voltage is not being recognized.	A. Listen for the high-pitched charging sound when charging is initiated. If it is heard, check A2A3TP4 and suspect A2A3U2D or a problem on the Vcap line to A2A2U102 pin 2. Use caution in the high voltage area.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
The defibrillator does not seem to charge. The displays indicates 0 joules, then in a few seconds displays "E2" and aborts charge. (Cont'd)	B. Cables A2A3P4, P18, P15; A2A3 power supplies; Fuse A2A3F1.	B. 1. Check cables A2A3P4, P18, P15 for proper connection and conduction. 2. Check the voltage at A2A3P4 pin 7 (SWBAT) with respect to A2A3TP1 (GND). It should be greater than 10V. 3. Check the voltage at A2A3P4 pin 1 (V RAW) with respect to A2A3TP6 (GND, RAW). It should be greater than 10V. 4. Check for fused V RAW voltage (on the right side of the fuse, looking at the component side of the board) with respect to A2A3TP6 (GND RAW). If it is less then V RAW, suspect A2A3F1. Remove the fuse and continue troubleshooting to find the cause of the failure.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
The defibrillator does not seem to charge. The display indicates 0 joules, then in a few seconds displays "E2" and aborts charge. (Cont'd)	C. A2A3U1 is not receiving the correct input or delivering the correct output.	C. With A2A3F1 removed, and during a charging attempt, ensure that: 1. A2A3U1 pin 10 is less than 700 mV. 2. A2A3U1 pin 7 has a sawtooth wave on it. 3. A2A3U1 pin 9 is above 1.5V. If not, and if CHG RATE CTRL is present, check A2A3TP2 and suspect A2A3U2C or U2B circuit. 4. A2A3U1 pin 1 voltage is less than pin 2 voltage. 5. A2A3U1 pin 4 voltage is less than 200 mV. 6. A2A3U1 pin 3 is not stuck high. If it is, check A2A3TP3 and suspect A2A3U2A and suspect A2A3Q2. 7. A2A3TP7 is toggling from about zero to > 10V.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
The defibrillator does not seem to charge. The display indicates 0 joules, then in a few seconds displays "E2" and aborts charge. (Cont'd)	D. Power MOSFET A2A3Q1 Transformer A2A3T1. (Cont'd)	D. With A2A3F1 removed, ensure that-- 1. The resistance from A2A3TP9 to A2A3TP7 is >1 Mega ohm with the positive ohmmeter lead is on A2A3TP9. 2. The resistance from A2A3TP7 to A2A3TP8 is >400 Mega ohm with the positive ohmmeter lead is on A2A3TP7. 3. The resistance from A2A3TP9 to A2A3TP8 is > 1 Mega ohm with the positive ohmmeter lead is on A2A3TP9. 4. The resistance from A2A3TP8 to A2A3TP9 is like a diode with the positive ohmmeter lead is on A2A3TP8. Then, with A2A3F1 in place, but when not attempting to charge. 1. Accurately measure the voltage from A2A3TP8 to A2A3TP6. If greater than 1mV, suspect A2A3Q1.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
The defibrillator does not seem to charge. The display indicates 0 joules, then in a few seconds displays "E2" and aborts charge. (Cont'd).	D. Power MOSFET A2A3Q1 Transformer A2A3T1. (Cont'd)	2. Measure the voltage at A2A3TP9. If less than V RAW, suspect A2A3T1 (primary). Then with A2A3F1 in place, and during a charging attempt, verify that A2A3TP7 is toggling from about zero to >10V. 1. If A2A3TP9 is not toggling, suspect A2A3Q1. 2. If A2A3TP9 is toggling, suspect A2A3T1 (secondary).
Slow charging (greater than 10 seconds to 360 joules with fully charged battery) or charge aborted with "E2" flashing on display.	A. A2A3P15 is disconnected.	A. Check A2A3P15 connection.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Slow charging (greater than 10 seconds to 360 joules with fully charged battery) or charge aborted with "E2" flashing on display. (Cont'd)	B. A2A3K1 not opening.	B. With the instrument turned on and all cables connected, verify that "E4", "E5" or "E7" are not displayed on the front panel. Measure the voltage at A2A3TP4 and verify that it is less than 50mV. Turn the instrument off and short the 2 terminals of the HV Capacitor (A2C1) with an insulated-handle screwdriver, then connect an ohmmeter from A2A3C11 to A2A3R19 (neither connection at the junction of A2A3C11 and A2A3R19). Also connect a jumper from A2A3TP10 (A2A3CR1 anode) to A2A3TP1 (A2A3CR4 anode). Turn the instrument on. If the resistance indicates a short, suspect A2A3K1. C. Disconnect A2A3P4, and measure the resistance across A2A3CR9. If a short is indicated, replace both A2A3CR9 and A2A3CR10.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Slow charging (greater than 10 seconds to 360 joules with fully charged battery) or charge aborted with "E2" flashing on display. (Cont'd)	D. A2A3 Charge rate control circuit problem.	D. During an attempt to charge, measure the voltage at A2A3TP2. If it is less than 1.5V, suspect A2A3U2C.
Charging begins, but then is aborted with "E3" flashing on the display.	A. HV Capacitor (A2C1) arc.	A. With the instrument turned on and all cables connected, verify that "E4", "E6", or "E7" are not displayed on the front panel. Measure the voltage at A2A3TP4 with respect to A2A3TP1 and verify that it is less than 50mV. Turn the instrument off and short the 2 terminals of the HV Capacitor (A2C1) with and insulated-handle screwdriver, then connect an ohmmeter across the 2 terminals. If the resistance settles to less than 30K ohms, suspect A2C1. Remove the ohmmeter.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Charging begins, but then is aborted with "E3" flashing on the display. (Cont'd)	B. A2A3 Capacitor voltage measurement problem.	B. Verify that A2C1 is not shorted (see section A directly above). Turn the instrument on and observe the voltage at A2A3U2 pin 12 during charge. After 800mV is reached, if there is >10% change in voltage within 10 ms, suspect transformer A2A3T1. Otherwise, measure the voltage at A2A3TP4. After 800 mV is reached, if there is >10% change in voltage within 10 ms, suspect A2A3U2D.
"E4" flashing on the display.	A. A2A3 Capacitor voltage measurement problem.	A. Measure the voltage at A2A3U2 pin 12. If it is greater than 50 mV, go to section B directly below. Otherwise, measure the voltage at A2A3TP4. If it is <50mV, suspect A2A3U2.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
"E4" flashing on the display. (Cont'd)	B. A2A3 Safety circuit problem.	B. After performing step A directly above, turn the instrument off to ensure that there is no safety relay drive. Wait at least 20 seconds. Then turn the instrument on. If the "E4" indication does not reappear on the display within 10 seconds, perform the following steps: 1. Check the voltage at A2A3TP4 to verify that it is less than 50 mV. 2. Short the HV Capacitor (A2C1) with an insulated-handle screwdriver. 3. Remove A2A3F1 for further troubleshooting. 4. Suspect SAF RLY DRIVE signal at A2A3TP10.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Battery Charger LED not working.	Battery Charger off.	Verify instrument is connected to AC source.
	BT1 Thermal Fuse.	Verify continuity between red and white wires (BT1P14 pins 1 and 3).
	Signal path.	Follow BATT CHG LED signal from A2A2 to A3A3.
	A2A2U401.	A2A2U401 pin 7 is logic low when charging battery.
Displays bright; frequent burnout.	+8.4V too high.	Check for +8.0V to +8.8V from A2A2.
LED's (A3A3 DS1, DS2, DS3) not lighting or dim.	+8.4V too low.	Check for +8.0V to +8.8V from A2A2.
	A2A2U204.	Check for voltages across A2A2R215 while in sync mode.
LED's (A3A3 DS1, DS2, DS3) not lighting correctly.	A3A3DS1, DS2, or DS3.	Check for drive signals to A2A2U204, and voltage across A2A2R214, 215, or 216.
One digit (A3A3DS4, DS5, DS6) not lighting correctly.	A3A3DS4, DS5, DS6, or A2A2U204.	Check for drive signals to A2A2U204. Interchange A3A3DS4, 5, 6 to determine if A2A2U204 or digit is bad.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
One segment on one digit not lighting correctly.	A3A3DS4, DS5, DS6.	Interchange A3A3DS4, 5, 6 to verify bad digit.
Same segment on all digits not lighting correctly.	A2A2U202.	Check for drive signals to A2A2U202. Check for voltage across A2A2R206 thru R213.
BTI battery not charging or instrument will not operate on AC only.	AC power.	Verify AC connected to appropriate power.
	A2A1 dead.	Verify 12 to 14.5V at A2A2P13 when AC is connected.
	A2A2K401.	Verify A2A2K401 is closed when AC is connected and open when AC disconnected (audible click).
	A2A2U401.	Verify A2A2U401 pin 1 is high when AC is connected.
	A2A2Q401.	Verify A2A2Q401 gate is high and transistor is conducting when AC is connected.
	BT1 Thermal fuse.	Verify continuity between red and white wires (BT1P14 pins 1 and 3).
+8V supply not operating correctly.	A2A2U405.	12 to 14V on A2A2U405 pin 3.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
+8.4V supply not operating correctly.	A2A2U404.	12 to 14V on A2A2U404 pin 3.
+5V supply not operating correctly.	A2A2U406	Square wave switching occurring on A2A2U406 pin 2.
-5V supply not operating correctly.	A2A2+5V circuit	Verify adequate load on +5V to allow charge pump to store charge on A2A2C421.
50/60 Hz noise on ECG trace.	Electromagnetically noisy environment.	Check grounding of nearby equipment.
	High electrode impedance.	Use Redux (P/N 651-1008-50) paste, abrade skin, press with 25lbs of force.
	Imbalance in paddles input impedance.	Compare resistance of A2A2R301-R306+5%.
	Used leads.	
ECG noise, not 50/60 Hz.	A2A2 Isolated circuits.	Short across A2A2T301 pins 1 and 2 and observe.
		Short across A2A2C302 and observe.
		Short across A2A2C301 and observe.
	A2A2 Grounded circuits.	Short A2A2U306 pin 1 to ground and observe.

Figure 3-109 (Continued)

GENERAL TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
ECG noise, not 50/60 Hz. (Cont'd)	A2A2 Grounded circuits. (Cont'd).	Short junction of A2A2R332 and R333 to ground and observe.
		Short A2A2U304 pin 3 to ground and observe.
Paddles amp does not meet 0.5Hz bandwidth spec.	A2A2C306, R325, R326.	Verify component values.
Paddles ECG Offset from center of displays.	A2A2R328.	Adjust ECG Offset.
	A2AU304.	Check Offset voltage and or high input bias currents on A2A2U304 pin 3.
ECG gain incorrect.	A2A2R331.	Adjust ECG gain.
	A2A2U305.	Measure ON resistance for each of eight multiplexer channels.

Figure 3-109 (Continued)

11. Determine the disposition of the unit.

    a. Prepare to release the unit to the user if the function check is satisfactory.

    b. Take the unit out of service if uncorrected deficiencies are present and they present danger to patients or operator or if the machine could be damaged due to continued use.

    c. Refer to the next higher echelon of maintenance, if necessary.

12. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.

    a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.

b. Obtain the user's signature for receipt of the unit, as appropriate.

c. Release the unit to the user.

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for operator's description of the equipment malfunction.	P	F
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.	P	F
3. Inspect the external surfaces of the defibrillator.	P	F
4. Perform a function check to confirm symptoms listed on DA Form 2407.	P	F
5. Read and interpret the error messages.	P	F
6. Remove the defibrillator from the case.	P	F
7. Troubleshoot and isolate the malfunction(s) to component level.	P	F
8. Determine if the repair cost exceeds the MEL.	P	F
9. Repair or replace the malfunctioning component.	P	F
10. Perform a function check.	P	F
11. Determine the disposition of the unit.	P	F
12. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P	F

REFERENCES:	***Required***	***Related***
	Manufacturer's Service Literature TB 38-750-2 TB Med 7	AR 40-61 AR 710-2

081-874-0034

REPAIR A PORTABLE VENTILATOR TO COMPONENT LEVEL

CONDITIONS

You have received a DA Form 2407 for repair of a portable ventilator. Necessary materials and equipment: DA Form 2409, TM 8-6530-009-24A&P, TB 38-750-2, TB Med 7, multimeter, current leakage tester, oscilloscope, circuit component test set, semiconductor tester, signal generator, electronic digital counter, tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The portable ventilator is functional in accordance with operational standards specified in TM 8-6530-009-24&P. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for the operator's description of the equipment's malfunction.	P	F
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart in Figure 3-110 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair cost.

NOTE: Under certain conditions the MEL may be waived. (See TB Med 7.)

Performance Measures **Results**

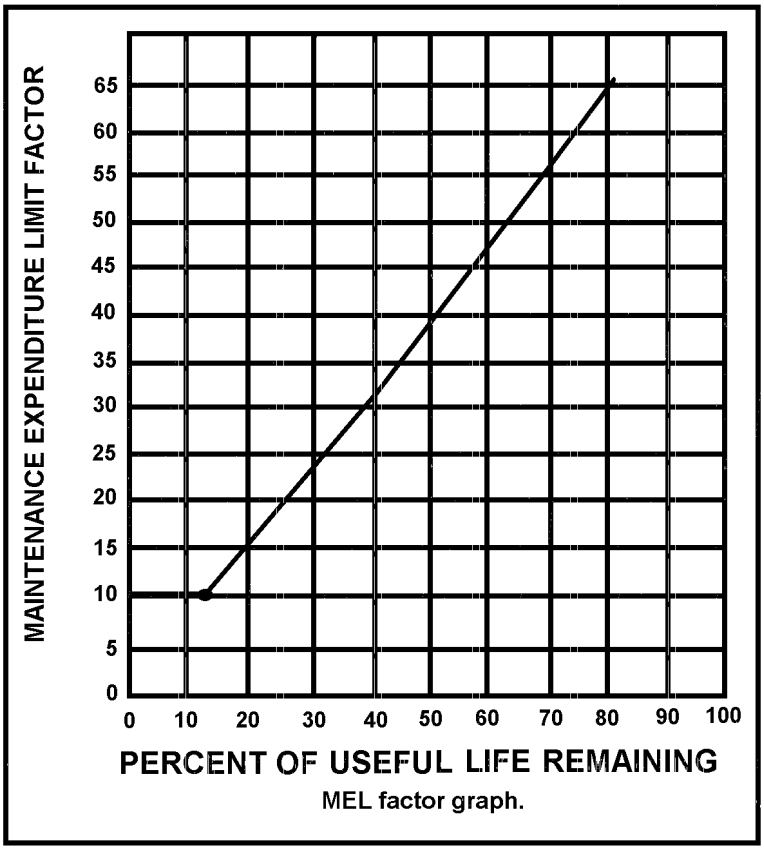


Figure 3-110

NOTE: The MEL for definite life equipment which has reached or exceeds its life expectancy is 10 percent. This MEL remains constant for as long the equipment is in use, regardless of the age.

3. Remove the cover from the unit. P F

4. Perform a visual inspection for-- P F

   a. Bare, exposed cable wires.

   b. Burned light bulbs.

5. Perform a function check to confirm symptoms listed on DA Form 2407. P F

Performance Measures	Results	
NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 11.)		
6. Troubleshoot and localize the malfunction to component level. (Refer to TM 8-6530-24&P, Chapter 4, Section 4-15.)	P	F
7. Determine if the repair cost exceeds the MEL.	P	F
NOTE: If the repair cost exceeds the MEL, notify the supervisor.		
8. Replace the malfunctioning component board.	P	F
9. Perform a function check.	P	F
10. Determine the disposition of the unit.	P	F
a. Prepare to release the unit to the user if the function check is satisfactory.		
b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.		
c. Refer to the next higher echelon of maintenance, if necessary.		
11. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P	F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.		
b. Obtain the user's signature for receipt of the unit, as appropriate.		
c. Release the unit to the user.		

REFERENCES:	***Required***	***Related***
	TM 8-6530-009-24&P	AR 40-61
	TB 38-750-2	AR 710-2
	TB Med 7	

081-874-0039

REPAIR A SINGLE PHASE RADIOGRAPHIC UNIT TO COMPONENT LEVEL (CONTINENTAL X-RAY UNIT)

CONDITIONS

You have received DA Form 2407 requesting repair of a single phase X-ray unit. Necessary materials and equipment: manufacturer's service literature, DA Form 2409, TB Med 7, TB 38-750-2, manufacturer's service literature, tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's service literature. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407.	P	F
2. Determine maintenance expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain the current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart at Figure 3-111 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair cost.

NOTE: Under certain conditions, the MEL may be waived. (See TB Med 7.)

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is ten percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

Performance Measures **Results**

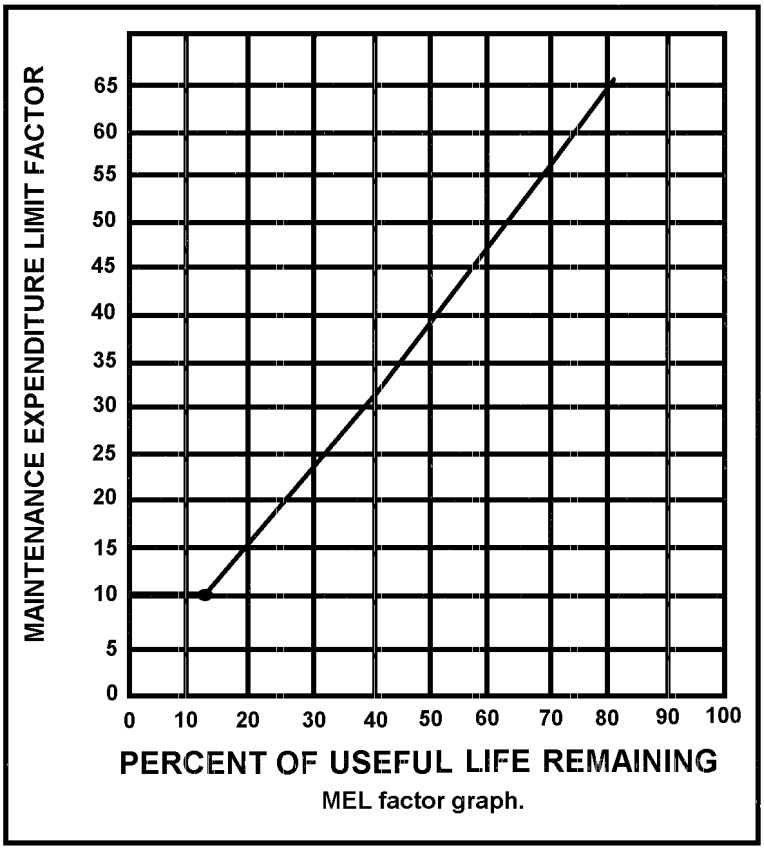


Figure 3-111

3. Perform a visual inspection. P F

a. Examine all cables for signs of damage.

b. Examine all connectors for signs of corrosion or damage.

c. Seat all connectors firmly in their sockets.

d. Check the X-ray generator, collimator, and remote hand control for signs of damage from a blow, dropping, or exposure to heat or moisture.

e. Inspect controls for maladjustment that may prevent normal operation.

4. Troubleshoot and isolate the malfunction to modular level. (Refer to the TROUBLESHOOTING section of the manufacturer's service literature.) P F

Performance Measures	Results
5. Troubleshoot and isolate the malfunction to component level. (Refer to the FOLDOUTS and circuit description section of the manufacturer's service literature.)	P F
6. Repair or replace the faulty component(s).	P F
7. Perform function check.	P F
8. Determine the disposition of the unit.	P F
a. Prepare to release the unit to the user if the function check is satisfactory.	
b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator if the machine could be damaged due to continued use.	
c. Refer to the next higher echelon of maintenance if necessary.	
9. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.	
b. Obtain the user's signature for receipt of the unit, as appropriate.	
c. Release the unit to the user.	

REFERENCES:	*Required*	*Related*
	Manufacturer's Service Literature TB 38-750-2 TB Med 7	AR 40-61 AR 710-2

081-874-0049

REPAIR A PROGRAMMABLE SUCTION PUMP TO COMPONENT LEVEL

CONDITIONS

You have received DA Form 2407 for repair of a programmable suction pump. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, manufacturer's service literature, tool kit (medical equipment organizational maintenance), individual tool box, and test measurement and diagnostic equipment.

STANDARDS

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's service literature. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for operator's description of the equipment malfunction.	P	F
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain the current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart at Figure 3-112 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.

NOTE: Under certain conditions, the MEL may be waived. (See TB Med 7.)

Performance Measures **Results**

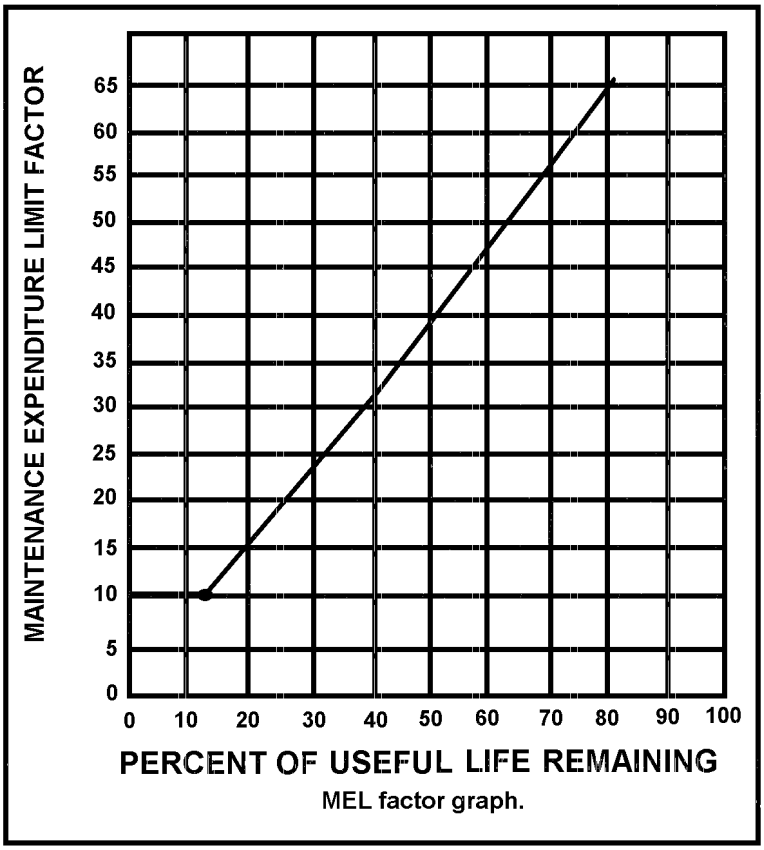


Figure 3-112

NOTE: The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

3. Visually inspect the equipment for burned, broken, loose, or missing components or wires. P F

4. Perform a function check to confirm symptoms listed on DA Form 2407. P F

NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 10.)

5. Troubleshoot the malfunction to component level. (See Figure 3-113.) P F

Performance Measures **Results**

TROUBLESHOOTING

Symptom:	Action:
No vacuum or weak vacuum.	Check controls: Master power switch on, continuous suction mode, high vacuum selected, regulator fully clockwise. Check hose and hose connections for cracks and crimps. Verify that pump turns easily and that set screws are tight between pump and motor. If L1 and L3 are illuminated, check for voltage at motor input, Q1-Q3, S5A, and R3. Momentarily select low vacuum level and verify voltage at R2. If L1 and L3 are both off, test to determine if L1 is open. Check S1A and S1B connections. Check for voltage outputs from D1-5 T1, S2A, and F1 on AC power line. Check for voltage output from B1, B2, and S2B on internal 12VDC line.
No internal battery power.	Check controls: Master power switch, power mode switch mode switch depressed. Check voltage at D6. Check for charging current going through R1 and into B1, B2. Check to see if L2 is illuminated. Check output of B1 and B2 through S2B.
Poor intermittent suction.	Check controls: Master power switch, intermittent suction mode, low vacuum level, regulator fully clockwise, timer set for 5 seconds, OFF timer set for 5 seconds. Check relay K2 for proper solenoid input signal. Verify that Q5's base voltage is 0VDC during ON cycles and 12VDC during OFF cycles.

Figure 3-113

Performance Measures **Results**

TROUBLESHOOTING (Continued)

Symptom:	Action:
Poor intermittent suction. (Cont'd)	Check relay K1 for proper input signal. Verify Q1 is also turning on and off at regular intervals.
	Check IC1 and Q4 for proper gating signals.
	Check the 5VDC regulator for proper output. If erratic operation continues, inspect the PC board closely for shorts, bad solder joints, and/or loose connector cables.
Motor will not turn on but solenoid activates.	Check IC3 and its associated circuits.
ON or OFF cycle does not terminate.	Check for loose or open connections between timing resistors R11 through R22 and IC2, pins 6 and 7, if stuck ON.
	Check for loose or open connections between timing resistors R23 through R34 and IC3, pins 6 and 7, if stuck OFF.

Figure 3-113 (Continued)

6. Determine if the repair cost exceeds the MEL. P F

NOTE: If the repair cost exceeds the MEL, notify the supervisor.

7. Replace the malfunctioning component. P F

8. Perform a function check. P F

9. Determine the disposition of the unit. P F

   a. Prepare to release the unit to the user if the function check is satisfactory.

Performance Measures	Results	
b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.		
c. Refer to the next higher echelon of maintenance if necessary.		
10. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P	F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.		
b. Obtain the user's signature for receipt of the unit, as appropriate.		
c. Release the unit to the user.		

REFERENCES:	*Required*	*Related*
	Manufacturer's Service Literature TB Med 7 TB 38-750-2	AR 40-61 AR 750-2

081-874-0057

REPAIR AN ELECTROSURGICAL APPARATUS TO COMPONENT LEVEL (FORCE 2)

CONDITIONS

You have received DA Form 2407 for repair of an electrosurgical (ES) apparatus. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, TM 8-6515-003-24&P, multimeter, ES analyzer, manufacturer's instructions for the ES analyzer safety analyzer, oscilloscope, semiconductor tester, signal generator, tool kit (medical equipment organizational maintenance), and individual tool box.

STANDARDS

The malfunction is isolated to component level and corrected. The electrosurgical (ES) apparatus is functional in accordance with operational standards specified in TM 8-6515-003-24&P. Results are recorded on DA Forms 2407 and 2409.

TRAINING/EVALUATION

Evaluation Guide

Performance Measures	**Results**	
1. Review DA Form 2407 for the operator's description of the equipment's malfunction.	P	F
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.	P	F

a. Obtain current replacement cost.

b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.

c. Use the chart in Figure 3-114 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.

d. Project a horizontal line to the MEL factor.

e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair cost.

NOTE: Under certain conditions, the MEL may be waived. (See TB Med 7.)

Performance Measures **Results**

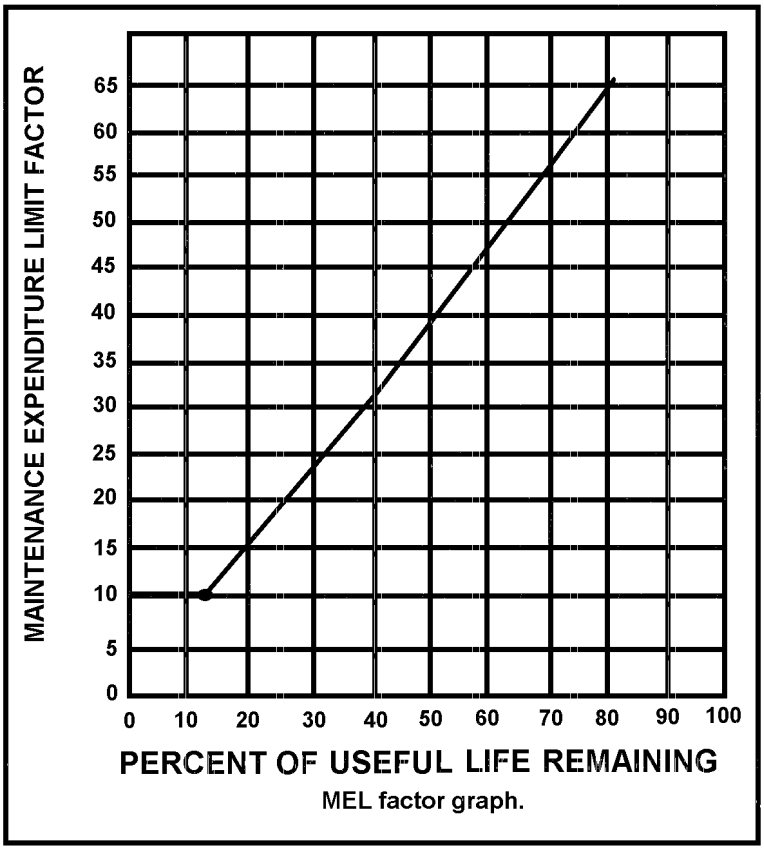


Figure 3-114

NOTE: The MEL for definite life equipment which has reached or exceeds its life expectancy is 10 percent. This MEL remains constant for as long the equipment is in use, regardless of the age.

3. Perform a visual inspection. P F

   a. Examine all cables for signs of damage.

   b. Examine all connectors for signs of damage.

   c. Seat all connectors firmly in their sockets.

   d. Check the unit for physical signs of damage or abuse.

4. Perform a function check to confirm symptoms listed on DA Form 2407. P F

Performance Measures	Results	
NOTE: If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 10.)		
5. Troubleshoot and isolate the malfunction(s) to component level. (Refer to TM 8-6515-003-24&P, Chapter 4, Section IV, paragraphs 4-14 & 4-15.)	P	F
6. Determine if the repair cost exceeds the MEL.	P	F
NOTE: If the repair cost exceeds the MEL, notify your supervisor.		
7. Replace the malfunctioning component. (Refer to TM 8-6515-003-24&P, Chapter 4, Section V, paragraphs 4-16 thru 4-18.)	P	F
8. Perform a function check.	P	F
9. Determine the disposition of the unit.	P	F
a. Prepare to release the unit to the user if the function check is satisfactory.		
b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.		
c. Refer to the next higher echelon of maintenance, if necessary.		
10. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P	F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.		
b. Obtain the user's signature for receipt of the unit, as appropriate.		
c. Release the unit to the user.		

REFERENCES:	***Required***	***Related***
	TM 8-6515-003-24&P	AR 40-61
	TB 38-750-2	AR 710-2
	TB Med 7	